



Mountaintop Surveillance Sensor Test Integration Center Facility, Kauai, Hawaii

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Final Environmental Assessment

May 2000

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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The purpose of the Proposed Action is to create the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility to provide a ground-based test capability to evaluate and compare new and updated sensor technologies. The EA addresses three sites: the Pacific Missile Range Facility- (PMRF) Kokee, PMRF-Makaha Ridge, and PMRF-Main Base. All sites are located on the Island of Kauai, Hawaii. The tower originally installed and removed as part of the Mountaintop Sensor Integration and Test program would be reinstalled at PMRF-Kokee. The existing radar antenna/pad would be modified to support sensors such as the Ultra High Frequency Electronically Scanned Array. Hardware and software systems would be developed and integrated. MSSTIC hardware would be installed and evaluated on existing towers at PMRF-Makaha Ridge. The hardware would be rotated between PMRF-Kokee and PMRF-Makaha Ridge approximately once every two years during the estimated 5-year test period. The sites would be returned to their original condition at the end of the testing period. Tests would involve using targets of opportunity such as aircraft and floating jammers. Facility support buildings could be constructed on the southern part of PMRF-Main Base within a 0.4-hectare (1-acre) area south of the existing Hawaii Air National Guard facility. If the program does not build on base, personnel would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.				
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DEPARTMENT OF DEFENSE
DEPARTMENT OF THE NAVY

FINDING OF NO SIGNIFICANT IMPACT (FONSI) FOR THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION CENTER FACILITY, KAUAI, HAWAII

Pursuant to the Council on Environmental Quality Regulations (40 CFR Parts 1500-1508) implementing procedural provisions of the National Environmental Policy Act (NEPA), the Department of the Navy gives notice that an Environmental Assessment (EA) has been prepared and an Environmental Impact Statement is not required to address the environmental impacts associated with creating a Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility.

The purpose of the MSSTIC Facility is to provide a ground-based test capability to evaluate and compare new and updated sensor technologies. This testing is essential to military readiness of existing and future operations world-wide. The primary radar equipment to be tested includes the Ultra High Frequency Electronically Scanned Array (UESA).

The EA addressed three sites: The Pacific Missile Range Facility (PMRF) - Kokee, PMRF- Makaha Ridge, and PMRF- Main Base. All sites are located on the Island of Kauai, Hawaii. The tower originally installed and removed as part of the Mountaintop Sensor Integration and Test program would be reinstalled at PMRF- Kokee. The existing radar antenna/pad would be modified to support the UESA. Hardware and software systems would be developed and integrated. MSSTIC hardware would be installed and evaluated on existing towers at PMRF- Makaha Ridge. The hardware would be rotated between PMRF-Kokee and PMRF- Makaha Ridge approximately once every two years during the estimated five year test period. The sites would be returned to their original condition at the end of the testing period.

Facility support buildings could be constructed on the southern part of PMRF- Main Base within a 0.4-hectare (1-acre) area south of the existing Hawaii Air National Guard facility. If the program does not build on base, personnel would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.

Analysis indicated that implementation of the MSSTIC Facility would not pose long-term or cumulative impacts at any of the proposed sites. Standard practices (watering) would minimize

localized dust emissions and soil erosion during construction of facilities on PMRF- Main Base. No change in airspace use or existing airspace coordination procedures would be required. Ground clearance on PMRF- Main Base would result in removal of a small amount of vegetation. Construction noise and an increased presence of personnel could temporarily affect wildlife in the immediate area. There will be no significant hazards of electromagnetic radiation to personnel, fuel, ordnance, or wildlife. There have been no reports of birds being affected by electromagnetic radiation from existing sensors located in the region. The small population of Hawaiian geese at PMRF- Makaha Ridge will not be affected.

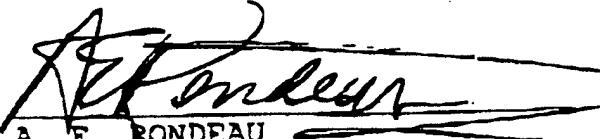
The only identified historic property within the PMRF is the Nohili Dune located north of the proposed site and outside the region of influence of proposed activities. An archaeological survey will be conducted prior to any ground-disturbing activities and all required consultation will be performed. Proposed activities would result in a continuation of the existing water supply problems at PMRF- Kokee and PMRF- Makaha Ridge. A new well currently being considered will reduce water demand impacts. No other impacts to infrastructure are anticipated. MSSTIC Facility activities will be consistent with existing uses of Federal land on PMRF.

There will be no known significant or adverse environmental impacts to minority or low-income communities as a result of the project as required by Executive Order 12898, Environmental Justice.

Based on information gathered during the preparation of the EA, the Department of the Navy finds that creation and operation of the proposed MSSTIC Facility will not significantly impact the environment.

The EA addressing this action may be obtained from: Commanding Officer, Pacific Missile Range Facility, Kekaha, Kauai, Hawaii 96752 (Attention: Mr. David Anderson, telephone (808) 471-335-4823).

09 MAY 2002
Date


A. E. RONDEAU
Captain, U.S. Navy
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Executive Summary

EXECUTIVE SUMMARY

Introduction

The purpose of this Environmental Assessment (EA) is to analyze the potential environmental consequences of creating a facility to provide a ground-based test capability to evaluate and compare new and updated sensor technologies. The proposed action would create the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility that provides a signal environment consisting of unique targets, clutter, and noise levels representative of operational surveillance and tracking radar for airborne, sea, and land conditions. These program activities would be performed in compliance with the National Environmental Policy Act; Department of Defense Directive 6050.1, *Environmental Effects in the United States of Department of Defense Actions*; Army Regulation 200-2, *Environmental Effects of Army Actions*; and Chief of Naval Operations Instruction 5090.1B, *Environmental and Natural Resources Program Manual*.

The Pacific Missile Range Facility (PMRF) has supported various test and evaluation programs in the past and environmental documentation exists. An EA was prepared in December 1993, and a Finding of No Significant Impact was published for the precursor to this project, the Mountaintop Sensor Integration and Test Program (MSITP). In addition, a supplemental MSITP EA was completed in 1995 that included a 33-meter (107-foot) tower/antenna structure to support testing of the Air-delivered Sensor (ADS)-18 antenna. The tower/antenna structure was removed after completion of testing. The 1993/1995 EAs addressed three possible sites: PMRF-Makaha Ridge, PMRF-Kokee, and Kokee Air Force Station (currently Hawaiian Air National Guard Radar Site).

Environmental impacts of recent radar programs at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have also been analyzed in the Advanced Concept Technology Demonstration of the Wide Area Defense Program EA, Army Mountain Top Experiment EA, and the PMRF Enhanced Capability Environmental Impact Statement.

Test Program Activities

Proposed activities would include reinstalling the MSITP antenna/pedestal structure at PMRF-Kokee; the use of existing facilities at PMRF-Makaha Ridge; and the potential construction of new support facilities on southern PMRF Main Base.

PMRF-Kokee—Proposed activities at PMRF-Kokee would include bringing in support trailers; reinstalling the tower evaluated for the MSITP program that was removed after the program's completion; setting up the antenna/pad; installing the MSSTIC hardware on the tower; and evaluating the system.

Personnel would be involved in the development and integration of hardware and software systems at the Kokee facility. The main emphasis at this facility would be the modification of the existing Radar Surveillance Technology Experimental Radar (RSTER) system to accommodate the Ultra High Frequency Electronically Scanned Array (UESA). The existing facility would be upgraded to include a tower capable of supporting the UESA antenna.

Radio Frequency (RF) transmission (at ultra high frequency) would occur at this facility in addition to testing of high power equipment utilizing RF dummy loads. The types of equipment that would be utilized at the PMRF facility are test instrumentation equipment (Oscilloscopes, Digital Multimeters, Network Analyzers, Logic Analyzers, Spectrum analyzers, etc.); small single station soldering equipment; cranes and other heavy equipment (during the tower construction and antenna installation phase); and computers/workstations. Only normal cleaning solutions (such as alcohol) and cooling fluids (such as ethylene glycol) would be required.

An instrumentation facility would be established inside the existing buildings at the PMRF-Kokee site, and the original tower would be reinstalled with a low profile antenna radome similar to the ADS-18S configuration (for a total height of less than the original 33 meters [107 feet] requested in the previous EA). In addition, the Inverse Displaced Phased Center Array (IDPCA) (originally utilized on the RSTER) would be mounted on the west side of the tower.

At the PMRF-Kokee site, the antenna would be mounted on a gray, galvanized steel tower and pedestal, to be re-erected as part of the site preparation. The overall height of the pedestal/antenna structure would provide a clear line-of-sight over existing vegetation

At PMRF-Kokee the radar will only be illuminated in a $190 \frac{1}{2}^\circ$ arc from 145° clockwise to $335 \frac{1}{2}^\circ$ True, centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Additionally, nighttime access (2000 to 0600 hours local) to the full 360° around PMRF-Kokee excluding a $\pm 20^\circ$ sector centered around the NASA site on Kokee parcel C is proposed under this EA.

PMRF-Makaha Ridge—Activities proposed for PMRF-Makaha Ridge would involve installing MSSTIC hardware on existing towers and evaluating the system. The hardware would be set up between PMRF-Kokee and PMRF-Makaha Ridge multiple times over a 5-year period depending on the program test to be supported, if only one sensor is available. This could occur approximately once every 2 years.

Support equipment for the radar system, located inside the PMRF-Kokee parcel A building, would be moved to the existing PMRF-Makaha Ridge shelter facilities when required. In addition, the PMRF-Makaha Ridge site has an existing antenna/pedestal unit that would be utilized for the ADS-18S effort. The antenna would be mounted on the existing tower for the duration of the testing period, after which the site will be returned to its original condition. One shelter at the PMRF-Makaha Ridge site would house the transmitter, the receiver, and the signal processing equipment. A second shelter would house the display and operations center, and a third shelter would house a limited maintenance facility for the site personnel. Each shelter is located on an existing concrete footing, weighs approximately 11,340 kilograms (25,000 pounds), and can be transported by tractor.

The PMRF-Makaha Ridge site would be utilized as is. There are no additional requirements for infrastructure improvements at this site for the support of this project. The original tower and the IDPCA tower located at this site would support program requirements.

At the PMRF-Makaha Ridge site, the program requires 24-hour access to a sector from 145° clockwise to 350° True, centered on the PMRF-Makaha Ridge site and extending 370 kilometers (200 nautical miles).

PMRF-Main Base—Activities proposed for PMRF-Main Base could include construction of facility support buildings within an area of 0.4 hectare (1 acre) south of the existing Hawaii Air National Guard facility in phases. During the first phase of construction, a 279-square meter (3,000-square foot) office/lab building and parking lot would be located within an estimated total area of 1,579 square meters (17,000 square feet). The need for additional facilities within this 0.4-hectare (1-acre) area is being evaluated. If the program does not build on base, they would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.

Personnel would be involved in the development and integration of hardware and software systems at the new PMRF-Main Base facility. The development efforts will involve the small scale breadboarding of electronic circuit subassemblies, testing and troubleshooting of electronic subassemblies, and programming at the workstation level. The types of equipment that would be utilized at the PMRF facility are test instrumentation (Oscilloscopes, Digital Multimeters, Network Analyzers, Logic Analyzers, Spectrum analyzers, etc.); small single station soldering equipment; and computers/workstations.

The use of hazardous chemicals (outside of the normal cleaning solutions such as alcohol) would not be required. In addition, no high power RF radiation transmission would occur at this facility. Any testing of high power equipment would be performed utilizing RF dummy loads.

Results

The analyses detailed in Chapter 4 indicated that implementation of the MSSTIC Facility program would not pose long-term or cumulative impacts on these environmental resources at the proposed locations.

Air Quality—Dust emissions during construction of facilities on PMRF-Main Base present the potential for impacts to air quality. Standard construction practices, such as watering, would be employed to minimize these impacts. No long-term impacts to air quality are expected.

Airspace—Proposed MSSTIC Facility activities would take place in existing Special Use Airspace that is cleared of nonparticipating aircraft. No changes in airspace use or existing airspace coordination procedures would be required.

Biological Resources—Ground clearance on southern PMRF-Main Base during construction of the proposed facilities would result in vegetation removal, habitat loss, and disturbance of wildlife. Construction noise and the increased presence of personnel could also affect wildlife in the immediate area. Birds may flush during sharp, loud noises but return to normal behavior within a short time. There have been no reports of birds being affected by electromagnetic radiation from the existing sensors located in the area. Birds are not expected to remain in the radar beam long enough to be adversely affected by

electromagnetic radiation. The small population of Hawaiian geese at PMRF-Makaha Ridge would not be adversely affected.

Cultural Resources—The only historic property identified within the PMRF is the Nohili Dune located north of the proposed site and outside the region of influence. Adherence with cultural resource mandates, consultation with applicable agencies, briefing of personnel on the importance of cultural resources, and protecting cultural resources from fire and fire-fighting damage will reduce the potential for adverse effects to non-adverse levels.

Geology and Soils—New construction would follow standard methods such as watering of excavated material to control erosion.

Hazardous Material and Waste—The use of hazardous chemicals (outside of normal cleaning solutions such as alcohol and cooling fluids such as ethylene glycol) would not be required.

Health and Safety—Existing safety operation manuals and procedures would be followed to minimize any risk to personnel health and safety.

Infrastructure—The proposed action would result in a continuation of the water supply problems currently at PMRF-Kokee and PMRF-Makaha Ridge. A new well currently being considered would reduce water demand impacts. No impacts to other utilities are anticipated.

Land Use—MSSTIC Facility activities would be consistent with existing uses of Federal land on the PMRF-Main Base.

Noise—Construction would be temporary in nature and similar to any commercial construction site. Noise generated would have minimal impact to off-base areas. No adverse impacts from generator noise are anticipated at PMRF-Kokee or PMRF-Makaha Ridge.

Visual and Aesthetics—The tower that is proposed for PMRF-Kokee would be galvanized steel that has oxidized to a dull finish, thus reducing reflectivity. There would be no change to the visual environment on Makaha Ridge. The building proposed for PMRF-Main Base would be visible from the road if a two-story building is constructed.

Water—The topography and permeability of soil in the area would limit the potential for impacts to water resources from construction activities.

Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS

ADS	Air-delivered Sensor
ATD	Advanced Technology Demonstration
CFR	Code of Federal Regulations
DLNR	Department of Land and Natural Resources
DOD	Department of Defense
EA	Environmental Assessment
EED	Electro-explosive Device
EIS	Environmental Impact Statement
EMR	Electromagnetic Radiation
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FY	Fiscal Year
HERF	Hazard of Electromagnetic Radiation to Fuel
HERO	Hazard of Electromagnetic Radiation to Ordnance
HERP	Hazard of Electromagnetic Radiation to Personnel
ICAO	International Civil Aviation Organization
IDPCA	Inverse Displaced Phased Center Array
IFR	Instrument Flight Rules
kV	Kilovolt(s)
kVA	Kilovolt Amperes
kW	Kilowatt(s)
MSITP	Mountaintop Sensor Integration and Test Program
MSSTIC	Mountaintop Surveillance Sensor Test Integration Center
mW/cm ²	Milliwatts per square centimeter

NASA	National Aeronautics and Space Administration
NAWC	Naval Air Warfare Center
NEPA	National Environmental Policy Act
PM-10	Particulate Matter Less than 10 Microns in Diameter
PMRF	Pacific Missile Range Facility
RF	Radio Frequency
ROI	Region of Influence
RSTER	Radar Surveillance Technology Experimental Radar
SCAMP	Spacecraft Antenna on Medium Pedestal
UESA	Ultra High Frequency Electronically Scanned Array
UHF	Ultra High Frequency
USB	Unified S-band
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
VLBI	Very Long Baseline Interferometry

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1.0 Purpose of and Need for the Proposed Action

1.0 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

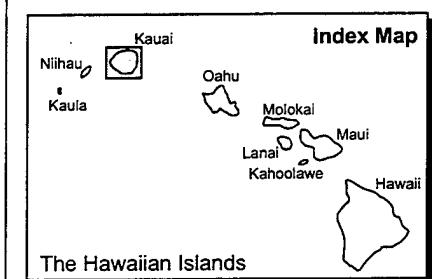
The National Environmental Policy Act (NEPA) of 1969, as amended; the Council on Environmental Quality regulations implementing the NEPA (40 Code of Federal Regulations [CFR] 1500-1508); Department of Defense (DOD) Directive 6050.1, *Environmental Effects in the United States of DOD Actions* (U.S. Department of Defense, 1979); and Chief of Naval Operations Instruction 5090.1B (U.S. Department of the Navy, 1994), which implement these laws and regulations, direct the DOD and U.S. Navy officials to consider environmental consequences when authorizing or approving Federal actions.

Accordingly, this Environmental Assessment (EA) analyzes the anticipated environmental impacts associated with the creation of a Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. Elements of the facility would be located at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base. This facility would support various radar test and evaluation programs such as the proposed Ultra High Frequency (UHF) Electronically Scanned Array (UESA) Advanced Technology Demonstration (ATD) Program.

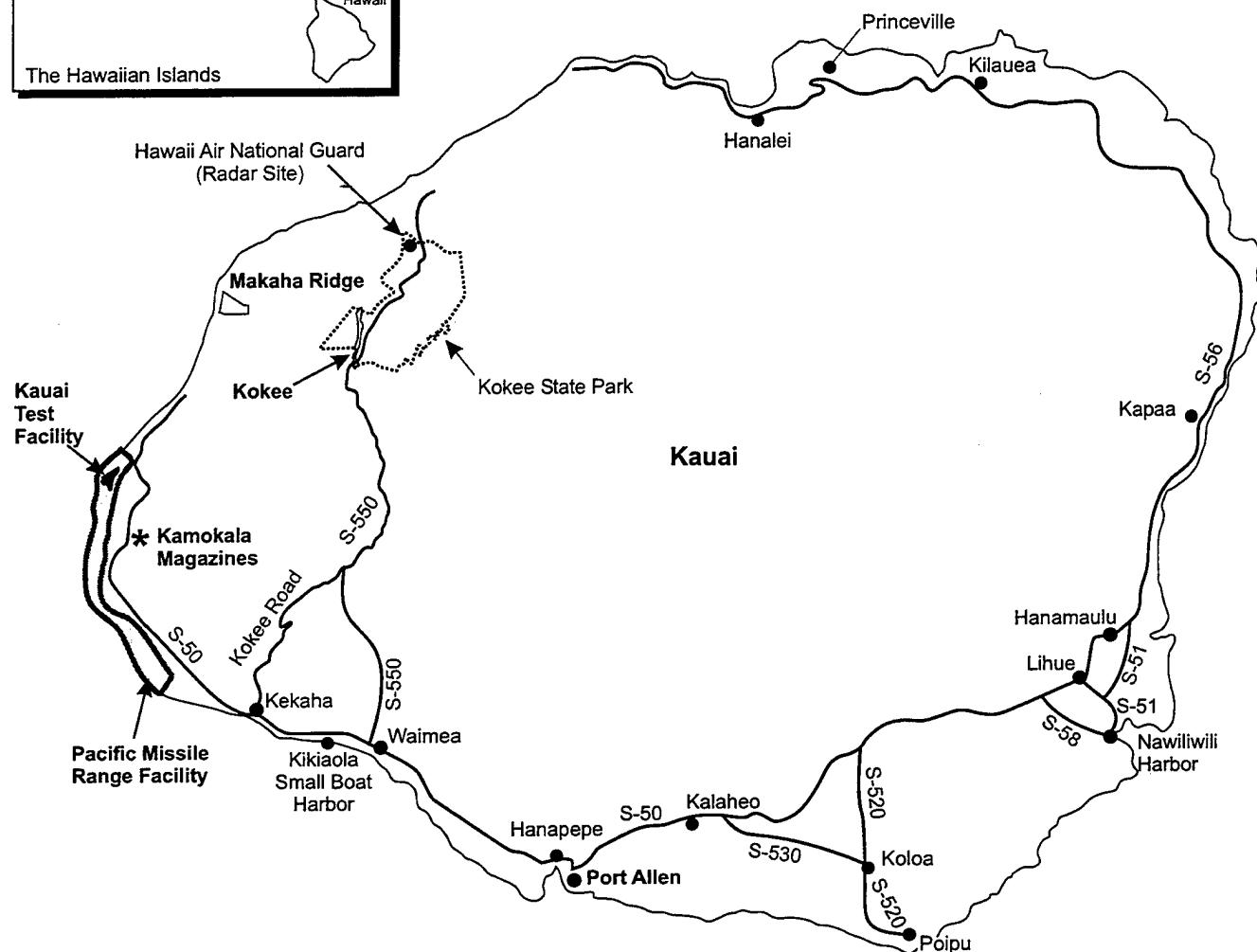
1.1 BACKGROUND

PMRF has supported various test and evaluation programs in the past and environmental documentation exists. An EA was prepared in December 1993, and a Finding of No Significant Impact was published for the precursor to this project, the Mountaintop Sensor Integration and Test Program (MSITP). In addition, a supplemental MSITP EA was completed in 1995 that included a 33-meter (107-foot) tower/antenna structure to support testing of the Air-Delivered Sensor (ADS)-18 antenna (U.S. Department of the Navy, 1995). The tower/antenna structure was removed after testing was completed. The 1993/1995 EAs addressed three possible sites: PMRF-Makaha Ridge, PMRF-Kokee, and Kokee Air Force Station (currently Hawaiian Air National Guard Radar Site).

Environmental impacts of recent radar programs at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have also been analyzed in the Advanced Concept Technology Demonstration of the Wide Area Defense Program EA, Army Mountain Top Experiment EA, and the PMRF Enhanced Capability Environmental Impact Statement (EIS) (section 1.4). All sites analyzed are located on the island of Kauai, Hawaii (figure 1-1).



Pacific Ocean



Source: Modified from U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-24.

EXPLANATION

S-50 = State Highway

..... Kokee State Park Boundary

Location of Pacific Missile Range Facility and Related Sites on Kauai



Scale

0 4.1 8.1 Kilometers
0 2.5 5 Miles

kauai_01

Kauai, Hawaii

Figure 1-1

MSSTIC Facility EA

1.2 PURPOSE AND NEED

Purpose

The purpose of the Proposed Action is to create a facility to provide a ground-based test capability to evaluate and compare new and updated sensor technologies. The Proposed Action would create the MSSTIC Facility that provides a signal environment consisting of unique targets, clutter, and noise levels representative of operational surveillance and tracking radar for airborne, sea, and land conditions.

The MSSTIC Facility would support various programs in testing different types of radar technologies; assist in the development of advanced long-range surveillance sensors; and provide a land-based capability to test different types of radar technologies and sensors without the expense of flying. It could also be integrated into ongoing test and training exercises at PMRF and its offshore range.

The Kauai sensor locations are unique in that they provide a suitable altitude and depression angle, near-in ground clutter, controlled airspace, targets of opportunity, existing infrastructure, and environmental considerations.

Need

The cruise missile threat, which emerged in the late 1960s, has continued to proliferate and evolve in sophistication. Any country or independent interest can potentially obtain cruise missile capability. Current cruise missiles have the potential to challenge existing weapon detection systems by flying low, using terrain-following flight paths, and presenting small radar signatures that are difficult to separate from surface background clutter. These cruise missiles may soon pose a threat to U.S. ground forces and associated infrastructure. The effectiveness of cruise missiles against military targets was reinforced by U.S. success in using cruise missiles during Operation Desert Storm.

Current ground-based defense capabilities are limited to line-of-sight between the weapons system and the target. This severely limits the amount of time available for ground-based air defense systems to respond and intercept the incoming missile. The trend toward cruise missiles with higher speed, lower altitudes, and stealth technology further increases the threat. The U.S. Navy needs a unique capability to support the development of advanced sensor technologies. Testing of new radar systems is essential to military readiness of existing and future operations world-wide.

1.3 DECISIONS TO BE MADE

The decisions to be made by the U.S. Navy and supported by information contained within this EA are:

- Determining if the MSSTIC Facility should be established
- Whether to reinstall the antenna/pedestal structure at PMRF-Kokee
- Whether to update existing instrumentation at PMRF-Kokee and PMRF-Makaha Ridge
- Whether to construct new buildings at PMRF-Main Base

1.4 RELATED ENVIRONMENTAL DOCUMENTATION

Actions similar to the actions of this program, have been previously documented in the following EAs*:

Office of Naval Research, 1995. *Environmental Assessment, Advanced Concept Technology Demonstration of the Wide Area Defense Program*, April.

U.S. Army Space and Strategic Defense Command, 1995. *Army Mountain Top Experiment Environmental Assessment*, May.

U.S. Department of the Navy, 1993. *Environmental Assessment, Mountaintop Sensor Integration and Test Program*, December.

U.S. Department of the Navy, 1995. *Supplemental Environmental Assessment, Mountaintop Sensor Integration and Test Program*, February.

*Each of these EAs resulted in a Finding of No Significance.

The environmental analysis presented in this EA has been prepared using additional appropriate information from the following:

U.S. Army Strategic Defense Command, 1992. *Final Environmental Impact Statement for the Strategic Target System*, May.

U.S. Department of the Navy, 1998. *Pacific Missile Range Facility Enhanced Capability Final Environmental Impact Statement*, December.

1.5 APPLICABLE REGULATORY REQUIREMENTS AND COORDINATION

Appendix A describes all applicable laws and regulations that would be followed.

2.0 Description of Proposed Action and Alternatives

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The U.S. Navy plans to establish a MSSTIC Facility at PMRF that would support various programs in testing different types of radar technologies and assist in the development of advanced long-range surveillance sensors. This chapter describes the Proposed Action, alternatives considered but eliminated from further study, and the No-action Alternative.

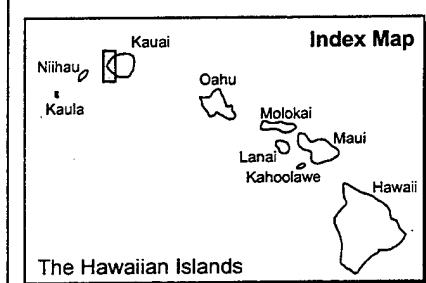
2.1 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The U.S. Navy requires a land-based capability to test different types of radar technologies and sensors without the expense of flying. The MSSTIC capability represents a system integration laboratory for the development of advanced long-range surveillance sensors. The PMRF is providing logistical and engineering support for the MSSTIC Facility. The MSSTIC Facility (figure 2-1) would be composed of facilities at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base.

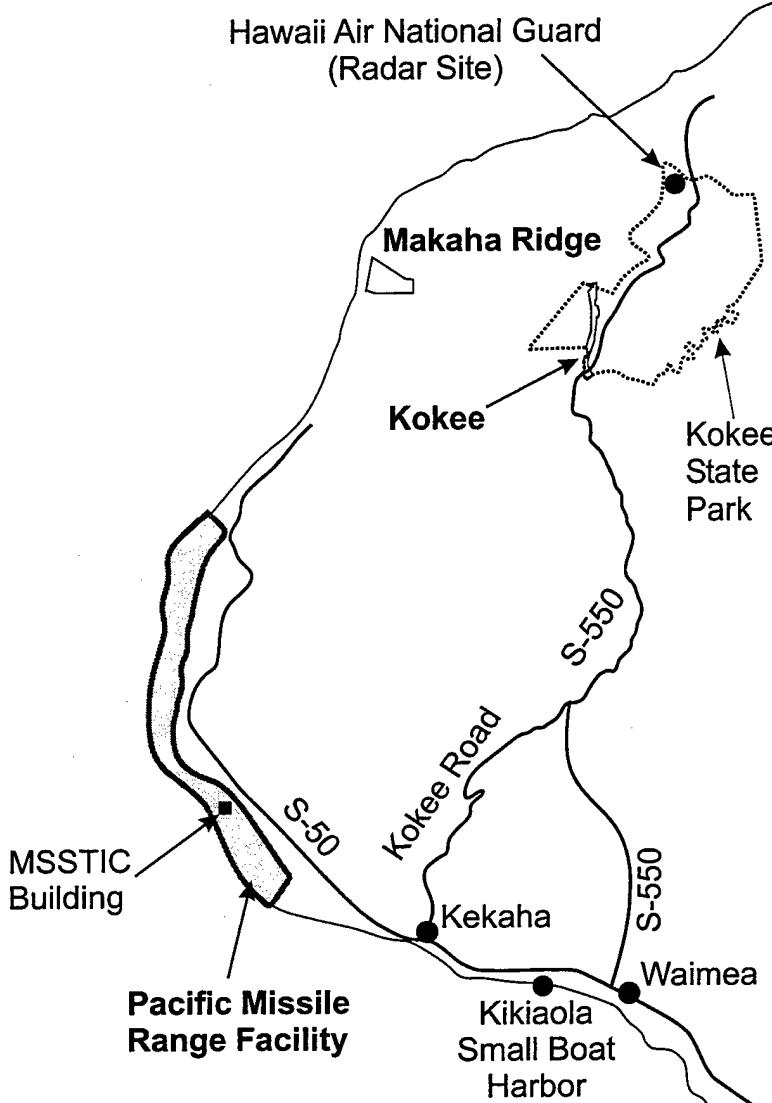
The proposed sensor location sites provide unique capabilities that are desirous to this program. The PMRF-Kokee site is at a higher altitude than the PMRF-Makaha Ridge site and provides a better test environment for longer-range detection scenarios (where Radar Line of Sight is important) required for modern systems. Neither of these sites alone meets 100 percent of the testing requirements for a sensor of this type. PMRF-Makaha Ridge represents a relatively clutter-free environment (to the west), which is ideal for characterizing antenna performance. In addition, this site has been utilized by the U.S. Navy to test the ADS-18S antenna and is therefore the logical place to perform a true comparison/analysis of the operational and performance differences between the two systems. Utilizing both the PMRF-Kokee and the PMRF-Makaha Ridge sites for the duration of this effort is paramount to the success of determining the UESA operational and performance characteristics.

Proposed activities at PMRF-Kokee would include reinstalling the tower evaluated for the MSITP program; setting up the antenna/pad; installing the MSSTIC hardware on the tower; and evaluating the system. Activities proposed for PMRF-Makaha Ridge would involve installing MSSTIC hardware on existing towers and evaluating the system. The hardware would be set up on an alternating basis between towers at PMRF-Kokee and PMRF-Makaha Ridge multiple times depending on the program test to be supported. This could occur up to approximately once every 2 years. The project is expected to last through 2006; however, follow-on testing may occur and requirements may exist up until 2010. Once requirements are met, the antenna and tower would be disassembled.

Proposed activities at PMRF-Main Base would include construction of facility support buildings in phases within an area of 0.4 hectare (1 acre) south of the existing Hawaii Air National Guard facility (figure 2-2). An archaeological survey would be conducted prior to



Pacific Ocean



Source: Modified from U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-24.

EXPLANATION

S-50 = State Highway

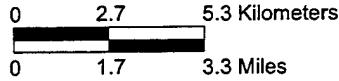
..... Kokee State Park Boundary

MSSTIC = Mountaintop Surveillance Sensor
Test Integration Center

Location of Pacific Missile Range Facility and Related Sites on Kauai



Scale

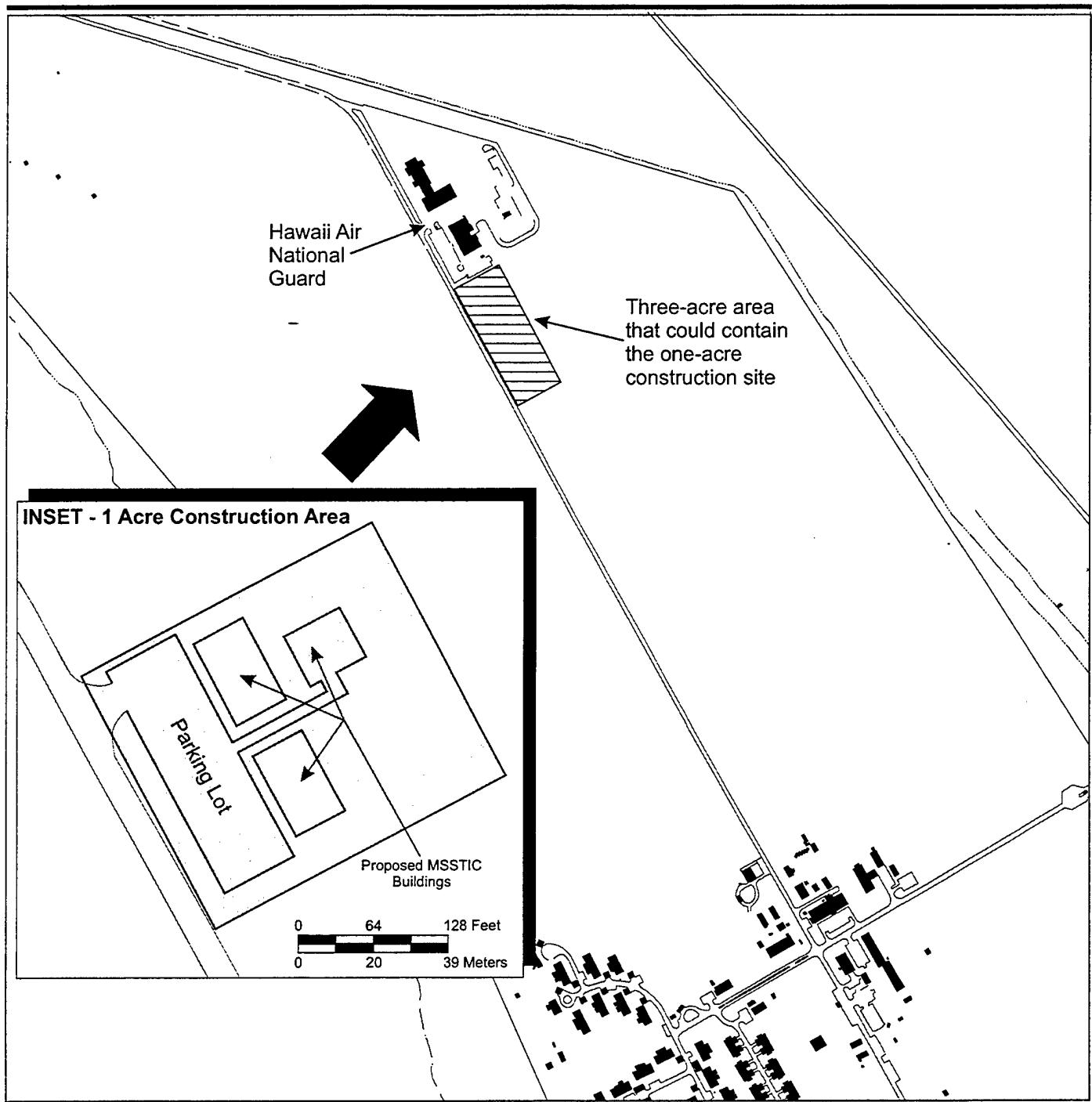


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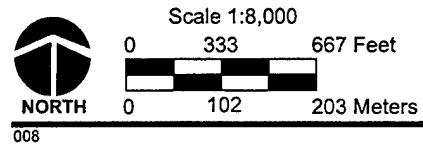
MSSTIC Facility EA

Kauai, Hawaii

Figure 2-1



Proposed Facility Support Building



MSSTIC Facility EA

Figure 2-2

any ground-disturbing activities. All required consultation would be performed. During the first phase of construction, a 279-square meter (3,000-square foot) office/lab building and parking lot would be located within an estimated total area of 1,579 square meters (17,000 square feet). The need for additional facilities is being evaluated. If the program does not build on base, they would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.

2.1.1 COMPONENT DESCRIPTIONS

Various radar models and the development of airborne antenna technologies can be performed at the test facility for analysis without the requirement for flying. The Proposed Action would create a facility that provides a signal environment consisting of unique targets, clutter, and noise levels representative of an operational airborne surveillance and tracking radar. The parameters that determined the final selection of the sites on Kauai included altitude, depression angle, near-in ground clutter, controlled airspace, targets of opportunity, site preparation, and environmental considerations.

The close proximity of PMRF and the offshore range to the PMRF-Kokee and PMRF-Makaha Ridge sites makes either or both of the locations uniquely suited to the tasks required for a thorough analysis of airborne sensors.

2.1.1.1 Sensors

Several sensors previously tested at PMRF (Radar Surveillance Technology Experimental Radar [RSTER], the Inverse Displaced Center Array [IDPCA], ADS-18S) and potential new systems (UESA) are described below.

Radar Surveillance Technology Experimental Radar

The RSTER is a long-range surveillance radar designed to provide surface ship detection and tracking capability against anti-shipping cruise missiles. The RSTER is transportable, has a self-contained phased array antenna, and transmits in the 406-450-megahertz frequency range.

The modification of the RSTER system to the MSSTIC capability involves replacing the UHF transmitter, adding a new set of UHF digital receivers for performance and maintenance reasons, and adding a new set of high speed digital recorders. Current transmit modules are over 10 years old and are becoming increasingly difficult to maintain. Additional work, related to upgrading the radar control and signal processing associated with the current RSTER design, would take place at the PMRF-Kokee facility.

Inverse Displaced Phased Center Array

The IDPCA is a transmit-only device that transmits in the 400-500-megahertz frequency range. It was designed to produce with the same spatial and temporal characteristics from a fixed site. Clutter returns are received through the larger RSTER-90 antenna.

ADS-18S

The ADS-18S antenna is an experimental upgrade antenna for the radar system of U.S. Navy aircraft. The antenna is enclosed in a rotodome and has azimuth scanning capability to approximately 60°. It has a horizontal array with 18 elements.

UESA

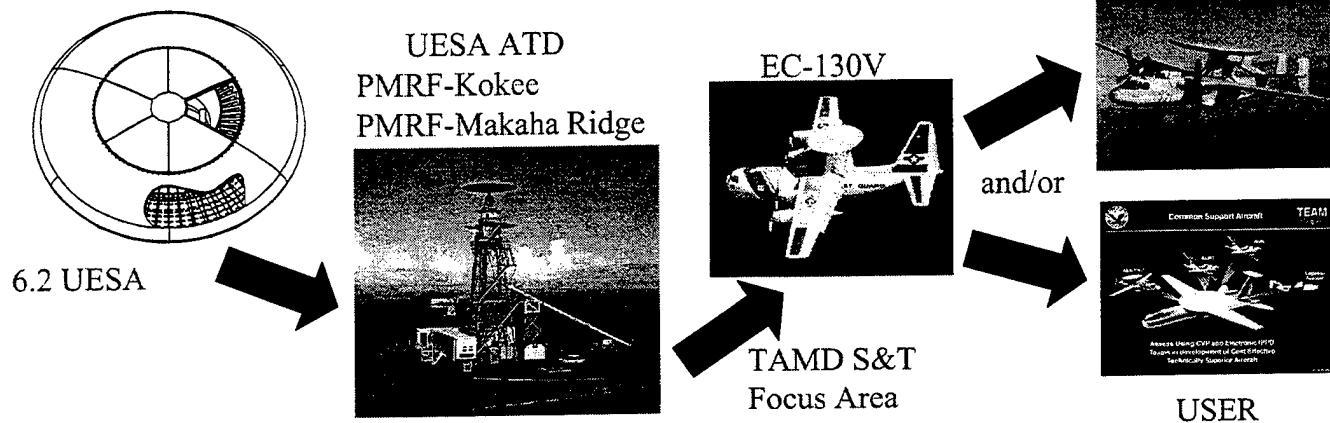
The UESA program (figure 2-3) is currently a Science and Technology program in a detailed design phase, which consists of full wave electromagnetic modeling, optimization, and construction of a full size array for testing and comparison to electromagnetic modeling. In fiscal year (FY) 1999, the UESA prototype antenna will be fully characterized on the contractor's outdoor range, and a procurement package for a flight certifiable Advanced Technology Demonstration (ATD) array will be developed. The ATD will fund the continued development of the full size, 360° high power capable UESA antenna complete with flightworthy radome (FY 2000/2001).

The balance of the ATD effort would be concerned with the modification to, and integration with, the RSTER, used recently in the Mountaintop Advanced Concept Technology Demonstration at both PMRF-Kokee and PMRF-Makaha Ridge. The program will culminate in a FY 2002 demonstration at the PMRF. The UESA radar will demonstrate periscope mast detection, plume detection, and "weapon quality" tracking of multiple high speed targets at arbitrary angles. This demonstration (figure 2-3) will be integrated by a joint Naval Air Warfare Center (NAWC)/PMRF/Massachusetts Institute of Technology Lincoln Labs team.

The UESA is enclosed in a rotodome 152 centimeters high and 8.5 meters in diameter (60 inches high and 28 feet in diameter), with an unlimited scanning capability (beam on demand). The UESA could represent a significant technological improvement for the next generation Airborne Early Warning platform. The array itself is a horizontal circular array with 54 elements and transmits in the 406-450 megahertz frequency range, as does the RSTER. The form factor of the ATD array is identical to that of the previously tested ADS-18S. The 6.2 array will have a low profile radome attached to the tower structure.

2.1.1.2 Support Capability/Equipment

An instrumentation facility would be established inside the existing buildings at the PMRF-Kokee site, and the 24-meter (80-foot) tower would be reinstalled. Various sensors typically with a low profile antenna radome (similar to the ADS-18S configuration) would



UESA Demonstration

Figure 2-3

be located on top of the tower. In addition, the IDPCA (originally utilized on the RSTER) would be mounted on the west side of the tower. Support equipment for the radar system, located inside the PMRF-Kokee Parcel A building, would be moved to the existing PMRF-Makaha Ridge shelter facilities when required. In addition, the PMRF-Makaha Ridge site has an existing antenna/pedestal unit that would be utilized, whereas the PMRF-Kokee site would require the reinstallation of the signal processing equipment. A second shelter would house the display and operations center, and a third shelter would house a limited maintenance facility for the site personnel. Each antenna/pedestal unit is described under the 1993/1995 EAs for the ADS-18S effort. One shelter at the PMRF-Makaha Ridge site would house the transmitter and the receiver. The shelter is located on an existing concrete footing, weighs approximately 11,340 kilograms (25,000 pounds), and can be transported by tractor.

2.1.2 INSTALLATION/SETUP/CONSTRUCTION

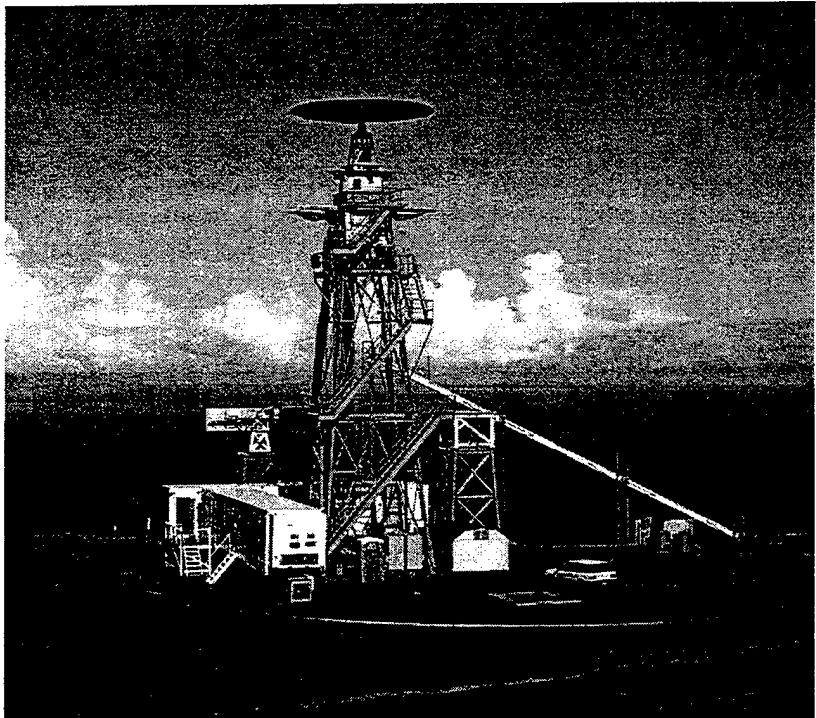
Many changes have occurred at the PMRF-Kokee site since the EAs mentioned in section 1 were completed. The original tower was removed and dismantled, although the tower footings remain intact. The equipment, originally installed in two 14-meter (45-foot) trailers, has been installed in the facility located at PMRF-Kokee, and both of the trailers originally utilized were removed from the premises.

The PMRF-Makaha Ridge site has also undergone additional changes since the 1993/1995 efforts. The ADS-18S antenna is being tested at the PMRF-Makaha Ridge site under the MRF-99 program. The final results of this effort would be the modification of the site to include three 12-meter (40-foot) shelters and the original antenna support structure (concluded in approximately January 2000). The intent of the MSSTIC program is to utilize the PMRF-Makaha Ridge site as is. PMRF would provide air conditioning to all program sites. PMRF would provide ground support for handling, lifting, and moving the UESA equipment at PMRF-Makaha Ridge. There are no additional requirements for infrastructure improvements at this site for the support of this project. The original tower and the IDPCA tower located at this site would support the UESA requirements.

2.1.2.1 PMRF-Kokee

At the PMRF-Kokee site, the antenna would be mounted on a gray, galvanized steel tower and pedestal, to be re-erected as part of the site preparation. The overall height of the pedestal/antenna structure would be less than 33 meters (107 feet) at PMRF-Kokee. Previous analysis on this site concluded that an antenna/pedestal of this height would achieve the objectives of the test. The height would provide a clear line-of-sight over existing vegetation. Figure 2-4 shows a typical antenna/pedestal unit with an ADS-18S attached (the final antenna pedestal configuration at either site will closely approximate this figure).

PMRF would provide ground support for handling, lifting, and moving the UESA equipment at PMRF-Kokee. PMRF ground handling equipment (forklift, mobile crane, and bucket trucks) would also be available for use by the program. Transportation of the equipment from the originating point to PMRF would be performed by MSSTIC Facility personnel or



**Typical Antenna/
Pedestal Configuration**

Figure 2-4

their contractors in accordance with all applicable laws and regulations. Support vehicles, such as cranes or forklifts, would be coordinated with the PMRF Program Manager. Large cranes are normally shipped to Kauai by inter-island barge and require a police escort from the harbor to PMRF-Kokee. PMRF verifies that the crane company has proper documentation that certifies its equipment.

Personnel would be involved in the development and integration of hardware and software systems at the Kokee facility. The main emphasis at this facility would be the modification of the existing RSTER system to accommodate the UESA. The existing facility would be upgraded to include a tower capable of supporting the UESA antenna. Radio frequency (RF) transmission (at UHF) would occur at this facility in addition to testing of high power equipment utilizing RF dummy loads. The types of equipment that would be utilized at the PMRF facility are test instrumentation (Oscilloscopes, Digital Multimeters, Network Analyzers, Logic Analyzers, Spectrum analyzers, etc.); small single station soldering equipment; cranes and other heavy equipment (during the tower construction and antenna installation phase); and computers/workstations. Only normal cleaning solutions (such as alcohol) and cooling fluids (such as ethylene glycol) would be required.

When testing is completed at PMRF-Kokee, the radar equipment would be moved to PMRF-Makaha Ridge, at which time the site would be returned to its existing condition. The MSSTIC project would employ about nine personnel on a full-time basis.

2.1.2.2 PMRF-Makaha Ridge

As previously mentioned, the PMRF-Makaha Ridge site would be utilized in its current configuration. When required, the equipment would be transported from the PMRF-Kokee Parcel A building to the shelters located at the PMRF-Makaha Ridge site. The antenna would be mounted on the existing tower for the duration of the testing period, after which the site would be returned to its original condition.

2.1.2.3 PMRF-Main Base

Personnel would be involved in the development and integration of hardware and software systems at the new PMRF-Main Base facility. The development efforts would involve the small scale breadboarding of electronic circuit subassemblies, testing and troubleshooting of electronic subassemblies, and programming at the workstation level. The types of equipment that would be utilized at the PMRF facility are test instrumentation (Oscilloscopes, Digital Multimeters, Network Analyzers, Logic Analyzers, Spectrum Analyzers, etc.); small single station soldering equipment; and computers/workstations.

The use of hazardous chemicals (outside of the normal cleaning solutions such as alcohol) would not be required. In addition, no high power RF radiation transmission would occur at this facility. Any testing of high power equipment would be performed utilizing RF dummy loads.

2.1.3 OPERATION/TEST

The RSTER equipment would be installed at PMRF-Kokee and modified inside facilities at Parcel A. The UESA antenna would be integrated into the RSTER system, and low-level characterization testing would be performed. The modified RSTER equipment would be transported to PMRF-Makaha Ridge for re-assembly and testing. Limited low-power radar operations for system calibration and integration would also be conducted at both sites. Activities at PMRF-Kokee and PMRF-Makaha Ridge would be coordinated through Range Operations (Building 105) on PMRF-Main Base.

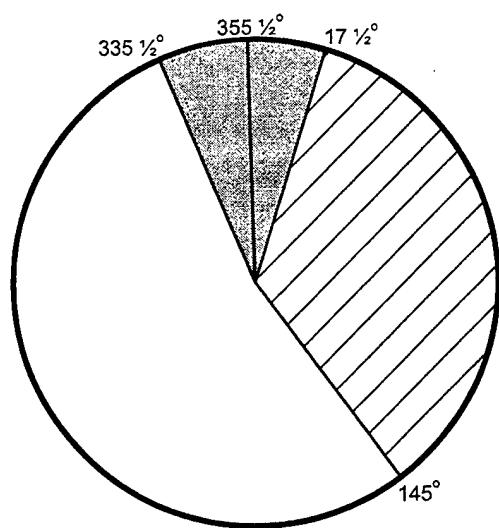
The current test schedule at PMRF-Kokee includes high power element, transmit pattern, receiver pattern, and on air tests, as well as data collection using targets of opportunity and range targets for approximately one year starting the second quarter of calendar year 2000. Near the end of the PMRF-Kokee test period, middle of the first quarter of calendar year 2001, the same types of tests would begin at PMRF-Makaha Ridge and would continue for approximately 18 months.

Tests would involve using targets of opportunity such as aircraft, ground-based and ship moving target simulators, and ground-based and floating jammers. One or two RC-12F/C-26 aircraft would be required, and Hawaii Air National Guard aircraft may also participate in the demonstration testing. Participating aircraft would abide by all PMRF Range Safety Office directives. Tests could require the use of moving target simulators and ground-based jammers located on existing PMRF range assets.

At PMRF-Kokee the radar would only be illuminated in a $190\frac{1}{2}^{\circ}$ arc from 145° clockwise to $335\frac{1}{2}^{\circ}$ True, centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Additionally, nighttime access (2000 to 0600 hours local) to the full 360° around PMRF-Kokee excluding a $\pm 20^{\circ}$ sector centered around the NASA site on Kokee Parcel C is proposed under this EA (figure 2-5).

At the PMRF-Makaha Ridge site, the program requires 24-hour access to a sector from 145° clockwise to 350° True, centered on the PMRF-Makaha Ridge site and extending 370 kilometers (200 nautical miles).

During the majority of the tests, the radar units would transmit at a frequency of 435 megahertz. Some tests may require other frequencies between 400 and 500 megahertz. Additional electromagnetic compatibility studies would be performed prior to the use of frequencies that have not been used before at the test sites. The peak power of the planned tests would be up to 140 kilowatts (kW) at PMRF-Kokee and 500 kW at PMRF-Makaha Ridge.



- Parcel "C" Exclusion Sector ($\pm 20^{\circ}$)
- Kokee Special Operating Area ($17\frac{1}{2}^{\circ}$ to $335\frac{1}{2}^{\circ}$)
5-10% of Actual Operating Time
- Kokee Standard Operating Area (145° to $335\frac{1}{2}^{\circ}$)
90-95% of Actual Operating Time

EXPLANATION

Operation centered at Kokee Parcel "A" out to 370-kilometers (200-nautical miles)

Area of Operations: Kokee Parcel "A"

Figure 2-5

A perimeter rope with caution and radiation warning signs would restrict access within 6 meters (20 feet) of the tower during periods of operation. A blue oscillating warning beacon would also be lighted when the radar is operating. A fail-safe system would be implemented to ensure that personnel from one project are never aloft and working on their equipment when another project is radiating.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

2.2.1 NO-ACTION ALTERNATIVE

Under the No-action Alternative, the U.S. Navy's ability to develop a unique capability to support the development of advanced sensor technologies would not be accomplished. No equipment would be reinstalled at PMRF-Kokee, no project-related activity would occur at PMRF Makaha-Ridge, and no project-related construction would be required at PMRF-Main Base.

2.3 ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

Previous Mountaintop program work with the RSTER system was performed at White Sands Missile Range in New Mexico. Although this site provides a unique clutter environment, it does not provide the unique targets of opportunity, the bluewater detection, the littoral environment, or the unique capabilities afforded this program from the close proximity with PMRF and the offshore range (periscope/mast detection, submarine launch, and close work with a multitude of Naval assets). Each of these capabilities is tied back to many of the operational requirements documents associated with the sensors being developed (including UESA). Therefore, this alternative was rejected.

NAWC Aircraft Division has facilities to perform testing of this nature; however, Radar Line of Site issues related to the lack of elevation and screening from adjacent facilities limit the capabilities to achieve the UESA test objectives. Therefore, this alternative was also rejected.

3.0 Affected Environment

3.0 AFFECTED ENVIRONMENT

This section describes the environmental characteristics that may be affected by the Proposed Action at all applicable sites. In order to provide a baseline point of reference for understanding any potential impacts, the affected environment is concisely described; any components of greater concern are described in greater detail.

Available reference materials, including EAs, EISs, and base master plans, were reviewed. Questions were directed to installation and facility personnel; Federal, state, and local regulatory agencies; and private individuals. Site visits were also conducted to gather the baseline data presented below.

3.1 ENVIRONMENTAL RESOURCES

Fourteen broad areas of environmental consideration were originally considered to provide a context for understanding the potential effects of the Proposed Action and to provide a basis for assessing the severity of potential impacts. These areas included air quality, airspace, biological resources, cultural resources, environmental justice, geology and soils, hazardous materials and waste, health and safety, infrastructure, land use, noise, socioeconomic, visual and aesthetics resources, and water resources. Seven of the topics—air quality, cultural resources, geology and soils, hazardous materials and waste, noise, socioeconomic, and water resources—were not further analyzed for PMRF-Kokee or PMRF-Makaha Ridge. The proposed activities would not impact local or regional air quality or result in noise impacts at these two locations. No impacts are anticipated to cultural resources, geology and soils, or water resources at PMRF-Kokee or PMRF-Makaha Ridge since no ground disturbing activities are planned.

No increase in hazardous materials used or hazardous wastes generated is expected at any of the proposed locations. Although approximately nine jobs would be created by the Proposed Action, these personnel would be drawn from the existing workforce; thus minimizing potential beneficial impacts to the socioeconomic of the region. No adverse impacts to minority or low-income communities (Executive Order 12898, *Environmental Justice*) are anticipated since the region surrounding the project sites is a forest reserve or a state park.

The six areas of environmental consideration discussed and analyzed for PMRF-Kokee and PMRF-Makaha Ridge are airspace, biological resources, health and safety, infrastructure, land use, and visual and aesthetic resources. Air quality, cultural resources, geology and soils, and water resources are additional resources discussed and analyzed for the proposed activities at PMRF-Main Base. Several of the environmental components are regulated by Federal and/or state environmental statutes, many of which set specific guidelines, regulations, and standards. These standards provide a benchmark that assists

in determining the significance of environmental impacts under the NEPA evaluation process. The compliance status of each potential site, with respect to environmental requirements, was included in the information collected on the affected environment.

3.2 PMRF-KOKEE

PMRF-Kokee is operated jointly by PMRF and the National Aeronautics and Space Administration (NASA). It is located at an altitude of 1,131 meters (3,710 feet) above mean sea level within Kokee State Park, which is owned by the State of Hawaii and managed by the Department of Land and Natural Resources (DLNR), Division of State Parks (see figure 2-2).

Kokee consists of five parcels leased from the State of Hawaii (U.S. Department of the Navy, 1993). Kokee consists of tracking radars, telemetry, UHF/very high frequency communications, and command and control systems.

3.2.1 AIRSPACE

Airspace, while generally viewed as being unlimited, is finite in nature. It can be defined dimensionally by height, depth, width, and period of use (time). The Federal Aviation Administration (FAA) is charged with the overall management of airspace.

Region of Influence

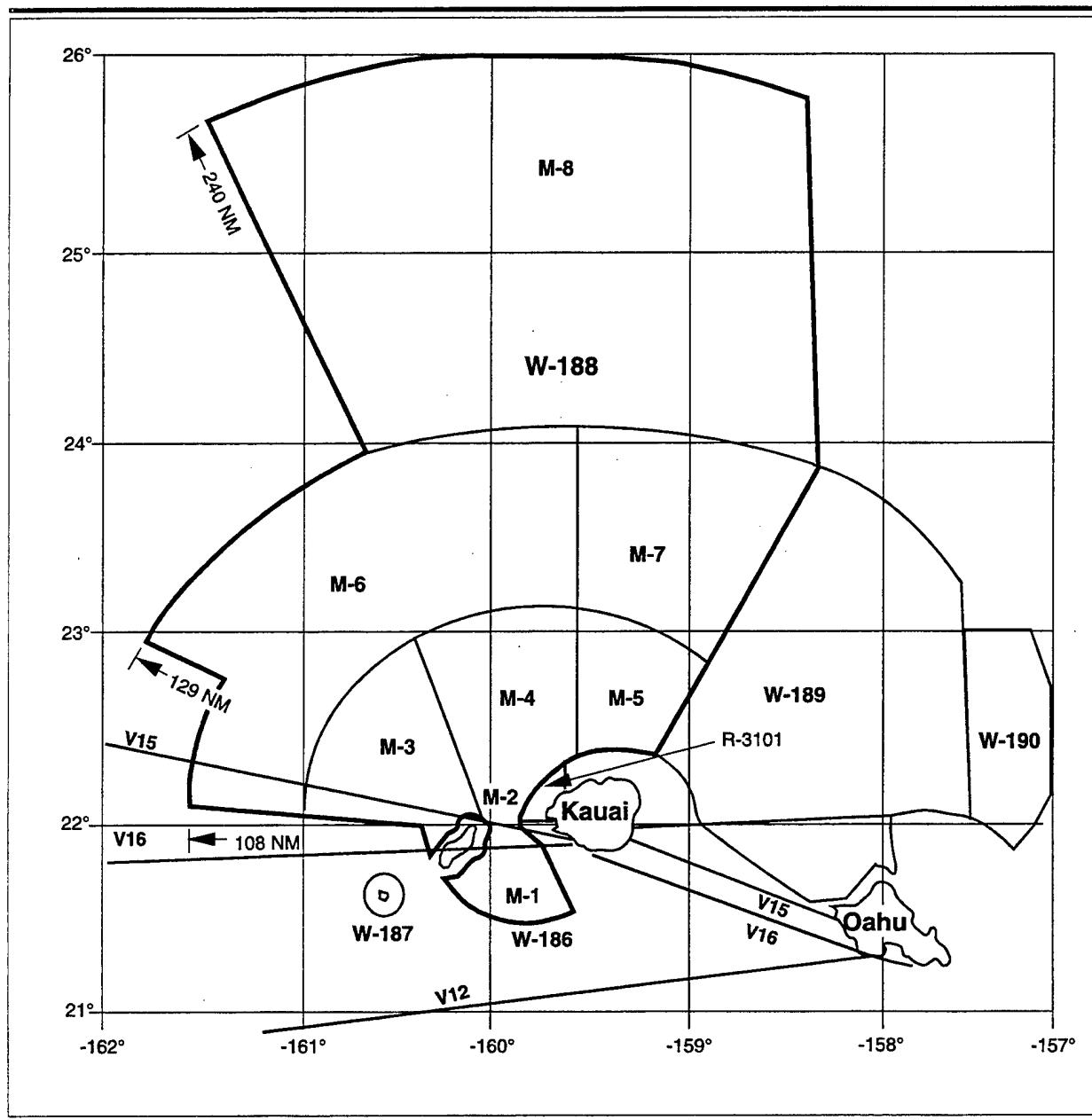
The Region of Influence (ROI) for airspace includes the airspace over and surrounding PMRF-Kokee and PMRF-Makaha Ridge. It includes the PMRF Operational Areas, the R-3101 Restricted Area, and surrounding airspace off the western and northwestern coast of Kauai (figure 3-1).

Special Use Airspace

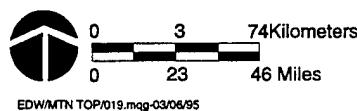
Restricted Areas are airspace segments within which the flight of nonparticipating aircraft, while not wholly prohibited, is subject to restriction. Restricted Area R-3101 has been established to provide the airspace required for PMRF to meet its primary missions (figure 3-1).

En Route Airways and Jet Routes

Although relatively remote from the majority of jet routes that crisscross the Pacific, the airspace ROI has two Instrument Flight Rules (IFR) en route low-altitude airways used by commercial air traffic that pass through the ROI: V-15, which passes east-west through the southernmost part of the Warning Area W-188; and V-16, which passes east-west through the northern part of Warning Area W-186 (figure 3-1). A count of the number of flights using each airway is not maintained.



**Special Use Airspace
and IFR En Route
Low-Altitude Airways**



EDW/MTN TOP/019.maq-03/06/95

Kauai, Hawaii

Figure 3-1

The airspace ROI, located to the west and northwest of Kauai, is far removed from the low-altitude airway carrying commercial traffic between Kauai, Oahu, and the other Hawaiian islands, all of which lie to the southeast of Kauai (U.S. Department of Commerce, 1994). There is a high volume of island helicopter sightseeing flights along the Na Pali coastline and over the Waimea Canyon. However, they do not fly into Restricted Area R-3101 (U.S. Department of Commerce, 1994).

Airports/Airfields

There are no airports or airfields in the ROI with the exception of the airfield at the PMRF-Barking Sands itself and the Kekaha airstrip approximately 3 miles to the southeast and 2 miles northwest of Kekaha. There is a heliport, used by PMRF personnel, located at the Makaha Ridge Instrumentation Site, as well as a heliport at Kokee Park used by State Park personnel. The standard instrument approach and departure procedure tracks for Kauai's principal airport at Lihue are all to the east and southeast of the island itself, well removed from the airspace use ROI. (U.S. Department of Commerce and U.S. Department of Defense, 1993)

Air Traffic/Range Control

Utilization of the airspace by the FAA and PMRF is established by a Letter of Agreement between the two agencies. By this agreement PMRF is required to notify the FAA by 1400 the day before range operations are going to infringe upon the designated airspace. Range Control and the FAA are in direct communication in real time to ensure safety of all aircraft using the airways and the Warning Areas (Pacific Missile Range Facility, 1991). Within the Special Use Airspace, military activities in Warning Areas W-186 and W-188 are under PMRF control. Warning Areas W-189, W-187, and W-190 are scheduled through the Fleet Area Control and Surveillance Facility.

The Warning Areas are located in international airspace. Because they are in international airspace, the procedures of the International Civil Aviation Organization (ICAO), outlined in ICAO Document 444, *Rules of the Air and Air Traffic Services*, are followed (International Civil Aviation Organization, 1985; 1994). The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the ROI is managed by the Honolulu Air Route Traffic Control Center.

3.2.2 BIOLOGICAL RESOURCES

Biological resources include two major categories: vegetation and wildlife. Existing information was reviewed on plant and animal species and habitat types in the vicinity of areas potentially affected by the Proposed Action. Special emphasis was placed on the presence of any species listed or proposed for listing by Federal, state, or local agencies as rare, threatened, or endangered.

Region of Influence

The ROI for biological resources encompasses the portions of PMRF-Kokee that could potentially be affected by the Proposed Action.

Affected Environment

Vegetation. A botanical assessment survey was conducted at Kokee in December 1992. The vegetation on the site is dominated by non-native species. No listed, candidate, or proposed threatened and endangered plant species were found, nor were any of the plants found considered rare and vulnerable. The site is surrounded by forested areas that are a mixture of exotic species and some native trees and shrubs. The area under the existing 9-meter (30-foot) tower, as well as around the Tracking and Command Building, is paved. (Office of Naval Research, 1995)

Wildlife. A bird and feral mammal survey was conducted at Kokee in December 1992. Two native bird species were observed at Kokee, the Pacific golden plover (*Pluvialis fulva*) and the common amakihi (*Hemignathus virens*). The Pacific golden plover is a native migratory bird that prefers open areas such as mud flats, fields, and lawns. The amakihi is a native land bird. Neither of these birds is endangered or threatened. (Pacific Division Naval Facilities Engineering Command, 1993)

Three species of exotic birds were observed at Kokee: the feral chicken (*Gallus gallus*), the common myna (*Acridotheres tristis*), and the Japanese white-eye (*Osterops japonicus*). These exotic birds are typical of those found in the region. In addition to these exotic species, the following birds may also occur at Kokee: the barn owl (*Tyto alba*), the white-rumped shama (*Copsychus malabaricus*), the Japanese bush-warbler (*Cettia diphone*), and the Eurasian skylark (*Alauda arvensis*). (Pacific Division Naval Facilities Engineering Command, 1993)

No evidence of rats or mice was noted at the facility, but these common mammals likely do occur on or near the site. There was evidence of feral pigs outside the fence line. Black-tailed deer (*Odocoileus hemionus*) occur in the Kokee area, but were not observed during the survey. (Office of Naval Research, 1995)

Threatened and Endangered Species. According to the Endangered Species Act, any species that is in danger of extinction throughout all or a significant portion of its range may be listed as an endangered species.

Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range may be listed as a threatened species. The State of Hawaii DLNR prepares its own list of threatened and endangered species, which includes federally listed species pursuant to Hawaii Revised Statutes 195-D. The Federal and State threatened Newell's shearwater (*Puffinus newelli*) may fly over the

Kokee site. Kauai provides the last Hawaiian habitat for this bird. (Pacific Division Naval Facilities Engineering Command, 1993)

3.2.3 HEALTH AND SAFETY

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect the well-being, safety, or health of workers or members of the public.

Region of Influence

The ROI for health and safety of workers includes the immediate work areas and radiation hazard areas. The ROI for public safety includes PMRF-Kokee and any bordering areas that may be affected by proposed activities.

Affected Environment

Hazards to health and safety potentially occur as a result of electromagnetic radiation (EMR) at the site. Hazards of EMR to personnel and fuel (called HERP and HERF, respectively) are the main concerns at Kokee. No ordnance is stored at the site, so there are no hazards of EMR to ordnance (HERO) issues. The only fuel stored at the site (diesel fuel for the electrical generators) is located outside of any EMR generating areas, so there are no HERF issues at the site. Appropriate sector blanking and the elevation of the radar units above the ground have eliminated any potential HERP issues at Kokee. To ensure conditions are safe, the site is regularly surveyed for radiation hazards, and all systems have warning lights to inform personnel when the radar units are operating. The public is not exposed to any unsafe EMR levels.

As discussed under airspace, aircraft are warned through aeronautical charts of the potential EMR hazards associated with Kokee operations.

3.2.4 INFRASTRUCTURE

Infrastructure elements include facilities and systems that provide power, water, wastewater treatment, and disposal of solid waste. Transportation routes are also considered part of a facility's infrastructure. The utilities potentially affected by the Proposed Action include potable (drinkable) and non-potable water.

Region of Influence

The ROI for infrastructure analysis encompasses PMRF-Kokee.

Affected Environment

Potable water is brought to Kokee by PMRF personnel and stored onsite. Non-potable water is provided by the State. When operations are being conducted at the PMRF-Kokee site during the dry summer months, water demand exceeds capacity, which impacts State Park operations. State Park personnel report that during high demand in the summer there is not enough water to operate park facilities. State-supplied water is used for toilets and washing vehicles, but is not used for radar operations. Under these drought conditions, sanitation water must be brought in. The current demand for water use is 2,593 liters (685 gallons) per day. Currently, only one well supplies water at Kokee. The well is 9 meters (30 feet) deep and has a capacity of approximately 76 liters (20 gallons) per minute.

During the dry months of the summer, the groundwater table is below 9 meters (30 feet) causing a water shortage in the system. Under these circumstances, sanitation water must be brought into the area. The State Park has implemented a mandatory water conservation program because current demand exceeds the capacity of the well. The park is drilling a new well that should be on-line within 1 to 2 years. This new well will have a capacity of 151 liters (40 gallons) per minute (218,039 liters [57,600 gallons] per day) and will have a depth of approximately 46 meters (150 feet). The Hawaii Department of Health has recommended that the old well be shut down because of sediment problems. (Yamada, 1997; Souza, 1997)

3.2.5 LAND USE

Both the state and Kauai County regulate land use on Kauai. The State of Hawaii Land Use Law classifies all lands into four categories: urban, rural, agricultural, and conservation.

The National Coastal Zone Management Act of 1972 requires Federal agencies to conduct activities in a manner consistent with the State of Hawaii's coastal zone management programs. The coastal zone of Hawaii includes all non-Federal property within the state. As part of the Coastal Zone Management Act, the County of Kauai has established guidelines or the review of developments proposed for special management areas. A small area east of PMRF-Main Base North Gate and Polihale State Park has been designated as a special management area. Any development in these areas would require a special management use permit.

Region of Influence

The ROI for land use analysis encompasses PMRF-Kokee affected areas.

Affected Environment

Kokee consists of five parcels leased from the State of Hawaii (U.S. Department of the Navy, 1993). Kokee consists of tracking radars, telemetry, ultra high frequency/very high frequency communications, and command and control systems. Kokee is situated within

Kokee State Park, which is owned by the State of Hawaii and managed by the DLNR, Division of State Parks. The land use around the site is used for recreational purposes and consists of open land that is heavily vegetated. The main highway through the State Park runs parallel to the existing facilities. According to the State Land Use Classification, Kokee is within a conservation use district. No maps have been adopted by the county that include this area for land use or zoning (U.S. Department of the Navy, 1993). None of the existing safety zones affect offsite land use. Currently, there are no land use conflicts with the surrounding land.

The buildings and structures of Kokee were originally part of the Kokee Tracking Station operated by NASA. NASA holds the lease for the property from the State of Hawaii. The Navy operates facilities on the Kokee site as part of its range operations. Kokee is made up of five parcels totaling approximately 9 hectares (23 acres), located almost in a straight line, with the extremities of the site being slightly less than a mile apart.

Parcel A is the most southerly site and houses the Tracking and Command Building, the Training and Administration Building, and the Logistics Building. Facilities at Parcel A are occupied periodically on a temporary basis. Parcel A is surrounded by a cyclone fence, and the area in the vicinity of the Tracking and Command Building has been graded and paved with asphalt. The ground elevation in the vicinity of the antenna tower is approximately 1,131 meters (3,710 feet) above mean sea level. (U.S. Department of the Navy, 1995)

A power plant and fuel storage area are located at Parcel B, which is about 427 meters (1,400 feet) to the north, across Highway 550. Parcel C, which is about 457 meters (1,500 feet) farther north, includes the Boresight Equipment Building, the Facilities Building, a microwave antenna, and the unified S-band (USB) collimation radar/boresight tower. Parcel D is farther up-slope and contains the Spacecraft Antenna on Medium Pedestal (SCAMP) Transmitter Building and SCAMP antenna, and the AN/FPS-16 Radar Building. Parcel E is 274 meters (900 feet) farther north. Parcel E houses the USB building and antenna and the Spacecraft Automatic Tracking Antenna receiver antenna in what is known as the Kokee Geophysical Observatory. Parcel E is also the site of the very long baseline interferometry (VLBI) facility, which is operated by NASA and the U.S. Naval Observatory. The balance of the Kokee parcels is composed of easements. (Office of Naval Research, 1995)

PMRF-Kokee is within Kokee State Park, home of the Waimea Canyon—one of the primary tourist destinations on Kauai. Many spectacular public viewing areas, including the Kalalau and Waimea Canyon Lookouts, are situated in the park, in addition to Kokee Lodge and Museum (U.S. Department of the Navy, 1993). A hiking trail is located near the Kokee facilities but is not affected by the operations.

3.2.6 VISUAL AND AESTHETIC RESOURCES

Region of Influence

The ROI for visual and aesthetic resources includes views within the boundaries of PMRF-Kokee.

Affected Environment

Kokee consists of radar units, buildings, and microwave towers. The site elevation varies from 1,131 to 1,144 meters (3,710 to 3,754 feet) over a distance of approximately 2 kilometers (1 mile). The topography both west and east of the site declines rapidly. Highway 550, which provides access to both facilities from Kaumualii Highway, extends about 29 kilometers (18 miles) to the Kalalau Lookout and is characterized as a winding road that is flanked by dense stands of trees, especially at higher elevations. Visibility is often restricted, not only by the vegetation but also by extreme changes in topography. Formal public lookouts offering spectacular vistas within Kokee State Park are the Waimea Canyon Lookout, the Puu Hinahina Lookout, the Kalalau Lookout, and the Puu O Kila Lookout.

The general ambiance of the drive through the park is one of lush foliage with occasional glimpses of Waimea Canyon. Throughout this drive, which terminates at approximately the 18-mile marker at the Kalalau Lookout, overhead electrical wires and utility poles parallel the roadway. There are other reminders of the built environment. At approximately the 9-mile marker, there is a microwave dish antenna that is approximately 31 meters (100 feet) high and clearly visible as it is approached from a downhill direction. Structures at PMRF-Kokee Parcel A can be seen during parts of the day depending on the sun's reflectivity. PMRF is negotiating with NASA and the State Park to agree upon painting the building a dark brown color to lessen the potential for reflection. (U.S. Department of the Navy, 1998)

Between the 14-mile and 15-mile markers, two antennas—one a 26-meter (85-foot) collimation tower for the USB receiving dish at the Kokee Geophysical Observatory and the second a 58-meter (190-foot) microwave antenna operated for PMRF—are clearly visible as they extend beyond the tree line. No other structures of the PMRF-Kokee site are visible from the highway as one travels uphill, including those at Parcel A. (U.S. Department of the Navy, 1998)

On the return drive toward Waimea, the USB receiving dish antenna is only occasionally visible through the trees between the 15-mile and 16-mile markers, as it extends above the tree line. It is most visible on the downhill approach to the Kokee Lodge for a lineal distance of about 91 meters (300 feet). In addition, the VLBI radio telescope at Kokee Geophysical Observatory is also visible along this portion of Highway 550. None of the facilities at Kokee are visible from the Waimea Canyon, Puu Hinahina, Kalalau, or Puu O Kila Lookouts within Kokee State Park. (U.S. Department of the Navy, 1998)

After proceeding past the Kokee Lodge, the next visible development is the existing antenna pedestal at Kokee Parcel A. The pedestal is visible for a length of about 91 meters (300 feet) along Highway 550 between the 14-mile and 15-mile markers, traveling in a downhill direction. When installed for a particular operation, the antenna protrudes above the tree line. Existing electric utility poles and lines are also prominent visual features of the landscape along this stretch of Highway 550. (Office of Naval Research, 1995)

3.3 PMRF-MAKAHA RIDGE

PMRF-Makaha Ridge, a secondary operations area for PMRF, is about 11 kilometers (7 miles) north of PMRF/Main Base. This 99-hectare (245-acre) complex is located approximately at the 488-meter (1,600-foot) elevation of Makaha Ridge and is leased from the State of Hawaii (see figure 2-1). Its primary mission in support of PMRF is to provide facilities for range operations at PMRF.

All Navy-controlled land at Makaha Ridge is reserved for range operations. The complex consists of tracking radars, antennas, communications, electronic warfare simulation, target command control, telemetry facilities, and a standby power plant. Data, communications, and command control commands are sent to and from PMRF/Main Base via a microwave system.

3.3.1 AIRSPACE

Section 3.2.1 provides a general description of airspace.

Region of Influence

The ROI for airspace includes the airspace over and surrounding PMRF-Makaha Ridge.

Affected Environment

The affected environment for airspace is the same as that provided in section 3.2.1.

3.3.2 BIOLOGICAL RESOURCES

Section 3.2.2 provides a general description of biological resources.

Region of Influence

The ROI for biological resources encompasses the portions of PMRF-Makaha Ridge that could potentially be affected by the Proposed Action.

Affected Environment

Vegetation. A botanical survey was conducted at Makaha Ridge in December 1992 as part of the MSITP. Vegetation at the sites is dominated by introduced non-native species. No rare, Federal or State candidate, or Federal or State proposed threatened and endangered plant species were found. Well-maintained grassy lawns and landscape plantings are located around the existing buildings. A few shrubs of the native false sandalwood or naio (*Myoporum sandwicense*) and the introduced lantana (*Lantana camara*) occur along the makai (coastal) edge of the Makaha Ridge complex. (U.S. Department of the Navy, 1993)

Wildlife. A wildlife survey conducted in December 1992 noted six bird species, including three endemic species, the white-tailed tropicbird (*Phaethon lepturus*), the Pacific golden plover, and the common amakihi. The golden plover is a migratory native bird, and the tropicbird is a native seabird. Three species of introduced birds commonly found in this area of Kauai were observed during the survey: spotted dove (*Streptopelia chinensis*), zebra dove (*Geopelia striata*), and the common myna. In addition, two native species that may occur in the area are the short-eared owl (*Asio flammeus sandwicense*) and the 'I'wi (*Vestiaria coccinea*). (U.S. Department of the Navy, 1993)

Although no evidence of mice or rats was observed, it is likely that these mammals inhabit the Makaha Ridge area. Feral goats (*Capra hircus*) were also seen in this general area. (U.S. Department of the Navy, 1993)

Threatened and Endangered Species. The threatened Newell's shearwater was not observed during the survey, but may fly over the site while foraging. In addition, the Federal and State endangered Hawaiian goose, or *ne ne*, (*Nesochen sandvicensis*) occurs as a breeding population within the Makaha Ridge facility. (U.S. Department of the Navy, 1998)

3.3.3 HEALTH AND SAFETY

A definition of health and safety is provided in section 3.2.3.

Region of Influence

The ROI for health and safety of workers includes the immediate work areas, radiation hazard areas, the launch site, and the flight corridor. The ROI for public safety includes PMRF-Makaha Ridge and any bordering areas that may be affected by proposed activities.

Affected Environment

Hazards to health and safety potentially occur as a result of EMR at the site. Hazards of HERP and HERF are the main concerns at Makaha Ridge. No ordnance is stored at the site, so there are no HERO issues. The helicopters that use the heliport at Makaha Ridge may have Electro-explosive Devices (EEDs); however, the area is below HERO unsafe

levels due to sector blanking of the area. A radiation hazard survey conducted in 1989 for PMRF including Makaha Ridge found no HERF issues and noted EMR levels from the AN/ALT-42 (Building 744) exceed HERP hazard levels in an area 1.5 meters (5 feet) from the AN/ALT-42 where personnel operate the AN/DPT-1s. HERP hazard levels were only exceeded when the AN/ALT-42 is transmitting at less than 240 degrees. To correct this problem, a light and sign were posted warning when the AN/ALT-42 is operating below 240 degrees (U.S. Department of the Navy, 1990). To ensure conditions are safe, the site is regularly surveyed for radiation hazards, and all systems have warning lights to inform personnel when radar units are operating. Because of Makaha Ridge's location at the end of a ridge, there are no health and safety issues associated with the public. As discussed under airspace, aircraft are warned through aeronautical charts of the potential EMR hazards associated with Makaha Ridge.

3.3.4 INFRASTRUCTURE

A general description of infrastructure is provided in section 3.2.4.

Region of Influence

The ROI for infrastructure analysis encompasses PMRF-Makaha Ridge.

Affected Environment

Water is supplied to Makaha Ridge through a 7.2-kilometer (4.5-mile) long, 5.1-centimeter (2-inch) diameter pipeline that is connected to a State of Hawaii water main at Kokee State Park. Three Navy-operated tanks, with a total capacity of 287,690 Liters (76,000 gallons), provide water storage for the complex. Although water provided by the Navy is chlorinated before distribution, it is not potable. Bottled water is provided for consumption. Monthly bacteriological analyses are conducted by the State Department of Health. (U.S. Department of the Navy, 1993)

The current water use demand is approximately 7,775 liters (2,054 gallons) per day. State water is used for toilets and washing of vehicles, but not for radar operations. Water shortage in the area is discussed in section 3.2.4.

3.3.5 LAND USE

Section 3.2.5 provides a general description of land use.

Region of Influence

The ROI for land use analysis encompasses PMRF-Makaha Ridge.

Affected Environment

Makaha Ridge consists of 99 hectares (245 acres) of land leased from the State of Hawaii (U.S. Department of the Navy, 1990). The facility consists of tracking radars, antennas, communication equipment, electronic warfare simulation, target command and control, telemetry facilities, and a standby power plant. All Navy-controlled land at Makaha Ridge is reserved for range operations. The terrain, EMR hazards, and security concerns constrain other types of land use. (U.S. Department of the Navy, 1993) None of the existing safety zones affect offsite land use. Currently, there are no land use conflicts with the surrounding land.

Makaha Ridge's location on the edge of a cliff limits any use of the land surrounding the site, with the general land use being open. The site is located within the Puu Ka Pele Forest Reserve. Current use of Makaha Ridge does not conflict with reserve management policies (Petteys, 1997). According to the State Land Use Classification, Makaha Ridge is within a conservation use district. No maps have been adopted by the county that include this area for land use or zoning. (U.S. Department of the Navy, 1993)

The only recreation area near Makaha Ridge is the Pine Forest Drive Picnic Area. This area is approximately 2 kilometers (1 mile) from the site, with the picnic area being located 0.40 kilometer (0.25 mile) off of the main road to Makaha Ridge. The site consists of two picnic areas and an arboretum. The actual number of daily visitors to the site is unknown, but State officials indicate that the site is frequently occupied and is also used as a starting point for hunters (Petteys, 1997).

3.3.6 VISUAL AND AESTHETIC RESOURCES

Region of Influence

The ROI for visual and aesthetic resources includes views within the boundaries of PMRF-Makaha Ridge.

Affected Environment

Makaha Ridge is extensively developed with radar and communication equipment and is one of many ridges north of PMRF that descends from the central highlands directly to the sea. The terrain is steep and the elevation changes abruptly. The elevation of the terrain varies from 445 meters (1,460 feet) to 564 meters (1,850 feet). The site offers exceptional vistas to the ocean below, but the site itself is not visible from Highway 550 in the immediate area and does not obstruct any prominent vistas. The site is visible from water craft traveling the ocean below and from a long distance on Highway 50 on the Mana Plain near the PMRF Main Gate. (U.S. Department of the Navy, 1993). In addition, hunters using the area in the Puu Ka Pele Forest Preserve around Makaha Ridge may be able to see the facility along some of the adjacent bluffs. (Petteys, 1997)

3.4 PMRF-MAIN BASE

3.4.1 AIR QUALITY

Region of Influence

The ROI for air quality impacts is the existing airshed surrounding the proposed site. This ROI encompasses the effects of both photochemically inert and reactive pollutants. Project emissions are compared to emissions generated in the region.

Affected Environment

Regional Air Quality. The only sampling station on Kauai is located in Lihue. It monitors for particulate matter less than 10 microns in diameter (PM-10). The air on Kauai meets all ambient air quality standards promulgated by the Environmental Protection Agency (EPA) and the state of Hawaii; therefore, the island of Kauai is in attainment for all criteria pollutants (40 CFR 81.312).

Air Pollution Emissions Sources. The main air pollution sources at PMRF-Main Base are diesel-fuel powered generators, aircraft, and rocket launches. PMRF-Main Base was issued a Title V Covered Source Permit for five diesel generators on 28 January 1998. This Air Permit covers all significant stationary emissions sources on the base. It specifically does not cover outlying areas. Aircraft emissions and missile exhaust emissions are both considered mobile sources and are thus exempt from permitting requirements.

The major source of air pollution emissions external to, and not associated with, PMRF-Main Base is the seasonal burning of the cane fields east of the base. This burning produces periods of elevated smoke and ash. In addition, the smoke temporarily degrades visibility over an extended area.

3.4.2 BIOLOGICAL RESOURCES

Section 3.2.2 provides a general description of biological resources.

Region of Influence

The ROI for biological resources encompasses the portions of PMRF-Main Base that could potentially be affected by the Proposed Action.

Affected Environment

Vegetation. The vegetation on PMRF/Main Base is composed of two principal habitat types: ruderal vegetation and kiawe (*Prosopis pallida*)/koa haole (*Leucaena leucocephala*)

scrub. The vegetation adjacent to PMRF-Main Base is dominated by sugar cane, ruderal vegetation, and wetlands associated with agricultural ponds and drains. Wetlands are also associated with the Mana base pond and Kawaiele wildlife sanctuaries, and agricultural drains within PMRF-Main Base. Kiawe/koa haole scrub and ruderal vegetation are the dominant vegetation in the undeveloped portions of the PMRF-Main Base ROI. Within PMRF-Main Base, ruderal vegetation is present where man has disturbed the natural vegetation. Much of the ruderal vegetation is mowed on a regular basis. Kiawe/koa haole scrub is dominated by the non-native, naturalized, woody species kiawe and koa haole. The understory, when present, consists of naturalized shrub and herbaceous species such as lantana (*Lantana camara*) and Guinea grass (*Panicum maximum*). Other introduced species are present beneath the kiawe in smaller numbers. Clearings in the kiawe are dominated by patchy, non-native, herbaceous species. In the south central part of PMRF/Main Base, mosaic-like patches of vegetation dominated by the indigenous species *Dodonea viscosa* are present on a sandy substrate. Ruderal vegetation, primarily composed of herbaceous, non-native species, is characteristic of disturbed areas, although native species may be present.

Wildlife. Forty species of birds have been identified at PMRF-Main Base, including non-native and migratory birds and species endemic to Hawaii. Non-native bird species on Kauai are usually common field and urban birds. Several species of migratory waterfowl may be present during some portion of the year.

The Laysan albatross (*Diomedea immutabilis*), a migratory bird protected under the Migratory Bird Treaty Act, uses ruderal vegetation areas for courtship and nesting. The Laysan albatross is being discouraged from nesting at PMRF/Main Base to prevent interaction between the species and aircraft using the runway. This action is being accomplished under a U.S. Fish and Wildlife (USFWS) permit.

The ring-necked pheasant (*Phasianus colchicus*) is one of several non-native game birds that occur throughout the PMRF-Main Base ROI. Other introduced, or exotic, species are generally common field and urban birds. (U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-11)

Feral dogs (*Canis familiaris*) and cats (*Felis catus*) occur in the region and prey on native and introduced species of birds. Rodents including the Polynesian black rat (*Rattus exulans*), Norway or brown rat (*Rattus norvegicus*), and the house mouse (*Mus musculus domesticus*) are also known to occur in the region. (U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-11)

Candidate, Threatened, and Endangered Species. Ten terrestrial species potentially occur on and adjacent to PMRF-Main Base (table 3-1).

Two federally listed plant species have been observed north of PMRF-Main Base. Ohai (*Sesbania tomentosa*), a federally endangered species of spreading shrub, has been observed in the sand dunes to the north of the base in Polihale State Park and might occur in or near the coastal area of PMRF-Main Base. However, this species was not observed during any of the floral surveys conducted within PMRF-Main Base in 1990. Lau'ehu

(*Panicum niihauense*), a federally endangered species of rare grass, has been observed near Queens Pond north of the base. (U.S. Army Strategic Defense Command, 1992, Feb, p.3-19; U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-12)

Table 3-1: Threatened and Endangered Terrestrial Species in the PMRF-Main Base Region of Influence

Scientific Name	Common Name	Status	
		Federal	State
Plants			
<i>Panicum niihauense</i>	Lau'ehu	E	E
<i>Sesbania tomentosa</i>	Ohai	E	E
Birds			
<i>Anas wyvilliana</i>	Koloa-maoli (Hawaiian duck)	E	E
<i>Asio flammeus sandwicense</i>	Pueo (Hawaiian short-eared owl)	N/A	E
<i>Fulica americana alai</i>	'Alae-ke'oke'o (American/ Hawaiian Coot)	E	E
<i>Gallinula chloropus sandvicensis</i>	'Alae-'ula (Hawaiian Gallinule/common moorhen)	E	E
<i>Himantopus mexicanus knudseni</i>	Ae'o (Hawaiian black-necked stilt)	E	E
<i>Pterodroma phaeopygia sandwicense</i>	Hawaiian dark-rumped petrel	E	E
<i>Puffinus auricularis newelli</i>	A'o (Newell's shearwater)	T	T
Mammal			
<i>Lasiurus cinereus semotus</i>	Hawaiian hoary bat	E	E

Source: U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-13.

Legend:

E = Endangered

N/A = Not applicable

T = Threatened

Six species of birds that are listed as federally threatened or endangered are potentially present or confirmed in the PMRF-Main Base area. Kauai provides the last Hawaiian habitat for the federally threatened Newell's shearwater. The Newell's shearwater nests from April to November in the interior mountains of Kauai. Nestlings are abandoned by the adults in October and November, they leave the nesting grounds at night and head for the open ocean. They become temporarily blinded by lights when flying near urban areas and have a tendency to collide with trees, utility lines, buildings, and automobiles. The most critical period for these collisions is 1 week before and 1 week after the new moon in October and November.

The dark-rumped petrel (*Pterodrome phaeopygia sandwicense*), which is listed as federally endangered, may traverse the area from their nesting grounds to the sea. Fledging of the dark-rumped petrel occurs in October, slightly earlier than that of the Newell's shearwater.

The Hawaiian (American) coot (*Fulica americana alai*), Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*), Hawaiian common moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*) are Federal and State endangered birds that have been observed in the drainage ditches and ponds on PMRF-Main Base.

'Alae-ke'oke'o (Hawaiian coot) is a Federal and State endangered subspecies of the American coot. It is limited to wetland habitats along agricultural drainage ditches and settling ponds (U.S. Army Strategic Defense Command, 1992, Feb, p.3-19 through 3-27). The 'alae-ke'oke'o is endemic to the Hawaiian Islands and is nonmigratory.

Ae'o (Hawaiian black-necked stilt) is a Federal and State endangered subspecies of the North American black-necked stilt. Habitat for this bird includes ponds, drainage ditches, and pasture lands. The ae'o is endemic to the Hawaiian Islands.

'Alae-'ula (Hawaiian Gallinule) is a Federal and State endangered subspecies of the common North American moorhen. It is expected to occur in drains and ponds in the region since its habitat is limited to wetlands along agricultural drainage ditches and settling ponds (U.S. Army Strategic Defense Command, 1992, Feb, p.3-19 through 3-27). The 'alae-'ula is endemic to the Hawaiian Islands and is nonmigratory with a range limited to Kauai and Oahu.

Koloa-maoli (Hawaiian duck) is a Federal and State endangered species of duck that has been observed in the wetlands of PMRF and the ditches of Mana. Habitat for the koloa-maoli includes marshes, drainage ditches, and wet agricultural land. The koloa-maoli is endemic to the Hawaiian Islands, with the only remaining native population on the Island of Kauai.

Pueo (*Asio flammeus sandwicense*) (Hawaiian short-eared owl) is a State listed endangered species. This short-eared owl is the only endemic terrestrial bird species that occurs in the region.

The native Federal endangered Hawaiian hoary bat (*Lasiurus cinereus* spp. *Semotus*) has not been observed at PMRF-Main Base, although it is known to feed offshore and has been observed at the Polihale State Park north of the base.

3.4.3 CULTURAL RESOURCES

Cultural resources are prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. Only those cultural resources determined to be potentially significant under the given legislation are subject to protection from adverse impacts resulting from an undertaking. For the purposes of this analysis, cultural resources are also defined to include paleontological resources.

Region of Influence

The ROI for cultural resources includes the property of PMRF-Main Base. The Area of Potential Effect is defined as the "geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if such properties exist." For this EA, the Area of Potential Effects is synonymous with the ROI.

Affected Environment

Archaeological Resources (Prehistoric and Historic). A review of existing archaeological and historical literature, records, and maps indicates that there are numerous recorded and unrecorded archaeological sites within the PMRF and surrounding area, some with subsurface components. Artifacts associated with the sites on the PMRF-Main Base include hearths, shell fishing lures, earth ovens, stone adze fragments, and human burials. Of the recorded sites, only one, the Nohili Dune, is eligible for inclusion in the National Register; the site is eligible as a traditional cultural property (Hawaii Department of Land and Natural Resources, State Historic Preservation Division, 1992a;b;c). However, because of the number and dispersed location of sites located within its boundary and the high probability that additional human burials may be present, the entire PMRF-Main Base could also be eligible (U.S. Army Strategic Defense Command, 1990).

Historic Buildings and Structures. All of the existing facilities within the boundary of the PMRF-Main Base were constructed between 1942 and 1995. None of these facilities are known to have been evaluated for eligibility for inclusion in the National Register; none are currently listed.

PMRF's Cultural Resources Management Overview Survey report of existing archaeological sites, historical records, and maps indicated that there are numerous recorded and unrecorded archaeological sites within PMRF and the surrounding area, some with subsurface components. (U.S. Department of the Navy, 1996, Aug, p.31 through 62)

Since the preparation of the Cultural Resources Management Overview Survey, PMRF has conducted a Phase I archaeological survey of the installation's previously unsurveyed areas. In addition, a historic resources survey (which includes PMRF's Cold War properties) was conducted (U.S. Department of the Navy, 1996, Aug, p.i, p.67).

The PMRF-Main Base is located within an archaeologically and ethnographically sensitive region of Kauai known as Mana. This area has been identified in traditional Hawaiian religious cosmology as *leina-a-ka-'uhane*. This term refers to the cliffs or seacoast promontories from which the spirits of the dead would enter the spiritual realm. The Nohili Dune area on the northern portion of PMRF-Main Base has been specifically cited in recorded Hawaiian oral literature as a burial area. Traditional Hawaiian mortuary practices indicate that human burials may be present in all sandy, coastal beach areas such as those at PMRF (U.S. Army Strategic Defense Command, 1992, Feb, p.3-27 through 3-28).

Except for the historic cemeteries, all archaeological resources at PMRF-Main Base are located within the shoreline dune system that forms the installation's western border. Currently documented sites extend from Barking Sands in the northern portion of the

facility to Waiokapua Bay in the south, indicating that the dune zone was used in the pre-contact period for burial interment and for seasonal habitation. Based on evidence provided by the number of burials along PMRF-Main Base's coastline, the dune zone at the facility can be delineated as an archaeologically sensitive zone with the potential to contain significant cultural resources throughout its north to south extension on the base. Inland from the dune area, archaeological evidence indicates the presence of distinct cultural resources. The two historic cemetery sites previously noted are situated in this interior area. The potential exists for the presence of other similar small, unmarked plantation period cemeteries in the interior area of PMRF-Main Base. The two zones which constitute the coastal portion of the installations property contain distinct cultural resources and both zones should be considered as archaeologically sensitive areas (U.S. Department of the Navy, 1996, p.63).

3.4.4 GEOLOGY AND SOILS

Region of Influence

The ROI encompasses the land within the boundary of PMRF-Main Base, specifically the those areas that would be directly disturbed by new construction.

Affected Environment

Physiography. PMRF-Main Base is situated on a strip of low-lying coastal terrace called the Mana Plain. The plain bounds the western flank of the island forming gentle westerly slopes ranging from about 2 percent near the volcanic uplands, to relatively flat over the coastal margin occupied by PMRF-Main Base. The plain does not form cliffs at the PMRF-Main Base shoreline. Local relief is formed by low beach barrier dunes, mildly undulating blanket sands, and the more prominent Nohili Dune located at the northern portion of PMRF/Main Base, adjacent to the northwest side of KTF at Nohili Point. Ground elevations over the facility average between 3.0 meters (10 feet) to 6.1 meters (20 feet) rising to 30.4 meters (100 feet) at Nohili Dune. Perennial or ephemeral streams do not traverse PMRF-Main Base. Surface runoff is controlled by manmade channels located at Nohili Ditch on northern PMRF-Main Base, Kawaiele Drainage in central PMRF-Main Base, and a drainage just south of Kawaiele Drainage.

Geology. The Island of Kauai is the result of a massive shield volcano, part of the chain of similar volcanoes that migrated northwest to southeast to form the Hawaiian archipelago. Kauai is the oldest of the eight main islands. Volcanic rocks exposed in the western half of the island are composed of Pliocene basaltic flows of the Waimea Volcanic Series (U.S. Army Strategic Defense Command, 1992, Feb, p.3-2). The volcanic terrain forms an abrupt, crescent-shaped scarp at the eastern boundary of the Mana Plain, the result of wave action from a higher sea stand. The surface of the volcanic basement complex plunges beneath the Mana Plain at approximately 5 degrees (U.S. Army Strategic Defense Command, 1992, Feb, p.3-3).

Soils. The U.S. Department of Agriculture (USDA) Soil Conservation Service published a soil survey that includes the surficial deposits of the Mana Plain (PMRF and Easement areas). The dominant soil within the PMRF area has been mapped as Jaucas loamy fine

sand, 0 to 8 percent slopes (U.S. Army Strategic Defense Command, 1992, Feb, p.3-4). The USDA describes this soil as occurring on old (inactive) beaches and on windblown sand deposits. It is pale brown to very pale brown sand, and in some cases it is more than 1.5 meters (5 feet) deep. In many places, the surface layer is dark brown as a result of accumulated organic matter and alluvium. The silt is neutral to moderately alkaline through its profile. It has an available water capacity of 0.1 to 0.2 centimeter/meter (0.05 to 0.07 inch/foot) of soil (U.S. Army Strategic Defense Command, 1992, Feb, p.3-4). The soils are permeable, and infiltration is rapid. Wind erosion is severe when vegetation has been removed. Lands within the PMRF-Main Base are not designated as agricultural land.

3.4.5 HEALTH AND SAFETY

Region of Influence

The ROI for health and safety of workers includes the immediate work areas, radiation hazard areas, the launch site, and the flight corridor. The ROI for public safety includes PMRF-Main Base and any bordering areas that may be affected by proposed activities.

Affected Environment

The Navy takes every reasonable precaution during the planning and execution of the operations, training exercises, and test and development activities to prevent injury to human life or property. In addition to explosive, physical impact, and electromagnetic hazards, potential hazards from chemical contamination, ionizing and non-ionizing radiation, radioactive materials, and lasers are studied by the Naval Air Warfare Center, Weapons Division. (U.S. Department of Defense, 1991, Sep, p.28)

Range Safety. All range users must: (1) provide a list of project materials, items, or test conditions that could present hazards to personnel or material through toxicity, combustion, blast, acoustics, fragmentation, electromagnetic radiation, radioactivity, ionization, or other means; (2) describe radiation, toxic, explosive, or ionization problems that could accumulate as a result of their tests; (3) provide warhead information (if any), aerodynamic and flight control information, and destruct system information and parameters; (4) submit plans, specifications, and procedural or functional steps for operations involving explosives to conform to criteria in the Naval Air Warfare Center, Weapons Division instruction; and (5) provide complete operational specifications of any laser to be used and a detailed description of its planned use. (U.S. Department of Defense, 1991, Sep, p.29)

Electromagnetic Radiation Management. EMR zones designated around transmitter sites and tracking radars are required where high-density electromagnetic power may constitute a HERP, HERO, or HERF, or may interfere with nonmilitary electronic equipment. All programs at PMRF are conducted in accordance with Commander Pacific Missile Test Center Instruction 5100.15, *Radiological Safety Manual* (U.S. Army Program Executive Office, 1995, May, p.4-13). The hazard levels associated with HERP are promulgated by Naval Operations Instruction 5100.23B Chapter 3, *Navy Occupational Safety and Health Program Manual*. PMRF uses a combination of establishing safety zones and conducting

sector blanking in occupied areas to avoid potential EMR exposure. To ensure exposure risks to personnel are minimal, the Navy conducts regular radiation hazard surveys before any modifications to a unit are made or when new radar equipment is installed. In addition, all radar units have red (radar unit is on) and blue (radar unit is emitting EMR) warning lights. EMR generated from PMRF radar units does not expose the public to any hazardous radiation.

3.4.6 INFRASTRUCTURE

Region of Influence

The ROI for infrastructure includes those systems within or immediately adjacent to the PMRF-Main Base.

Affected Environment

Electrical Supply. Kauai Electric Company provides commercial power to PMRF on Kauai. Power to the main base and northern complex area is supplied at 12.5 kilovolts (kV) from Kauai Electric Company's Mana substation. The power is reduced to 4.16 kV for distribution on-station by a 1,500-kilovolt ampere (kVA) transformer which serves the Operations Building Area, and by a bank of three 167-kVA transformers which serve the remainder of the base. The present peak power load of the northern complex area is 1,500 kVA. (U.S. Department of the Navy, 1990, Oct, p.D-41)

The 4.16-kV feeder from the 1,500-kVA transformer connects to switches in the main PMRF power plant, which serves as backup to the Kauai Electric Company system. The power plant contains two 600-kilowatt and three 300-kilowatt generator units. Primary power to the southern area of the base is supplied by a 12.5-kV feed system from Kauai Electric. (U.S. Department of the Navy, 1990, Oct, p.D-41)

Kauai Electric Company typically averages 50 or more power outages a year. Due to this unreliability, Range Operations receives electricity from the PMRF power plant, with commercial power used as a backup. (U.S. Department of the Navy, 1990, Oct, p.D-41)

Solid Waste Disposal. PMRF disposed of 1.16 million kilograms (1,146 tons) of refuse in the Kekaha landfill from 1 October 1995 to 30 September 1996 (Pacific Missile Range Facility, 1996, 30 Aug, p.A-10). The PMRF operations and maintenance contractor collects this refuse and delivers it to the county-operated sanitary landfill at Kekaha, which is the only operating landfill on Kauai. Current life expectancy of the landfill is until 1998. (Inouye, 1996, 10 Dec, p.1) The county is looking into acquiring additional lands from the State to meet future refuse requirements, and/or is seeking variants to increase the height of the landfill.

PMRF has a recycling program for aluminum cans, glass, and paper. Collection points are widely distributed at PMRF/Main Base facilities, and items are collected twice a week. The aluminum cans are sold; a nominal fee is paid to a commercial collector for the glass

items; and the paper is placed in regular recycled-paper dumpsters for collection by a commercial vendor (Tottori, 1997, 10 Mar, p.1). Green waste is collected and chipped for compost and use on the base.

Wastewater Treatment. PMRF has two wastewater treatment facilities: (1) a treatment plant 0.8 kilometers (0.5 miles) south of the Main Gate, and (2) an oxidation pond south of the family housing area. Effluent is discharged to a leachfield situated between the runway and the coast. The average flow for the period 6 June 1995 to 31 May 1996 was 35,961 liters (9,500 gallons) per day. This represented 37 percent of the design capacity of 98,420 liters (26,000 gallons) per day. (State of Hawaii, 1996, 4 Oct, p.3)

The oxidation pond in the southern portion of the base receives approximately 94,635 liters (25,000 gallons) per day of wastewater from Navy family housing and community/personnel support facilities. The capacity of the oxidation-leach pond is 204,412 liters (54,000 gallons) per day. No records are kept of the total daily flow for the stabilization pond. A recent Hawaii Department of Health operation and maintenance report suggested that pump run times from the pump station be used to estimate total daily flows for the pond. (State of Hawaii, 1996, 4 Oct, p.5) Effluent from the oxidation pond flows into a series of adjacent leaching ponds, where it is dissipated by percolation and evaporation.

PMRF also has approximately 24 septic tank/leachfield systems and cesspools serving individual buildings in the northern part of the main base.

Water. At PMRF-Main Base, potable water comes from the Kauai Board of Water Supply and Amfac Sugar-Kauai, who treat it. Total average consumption of Kauai County water by PMRF facilities in 1996 was approximately 193,699 liters (51,170 gallons) per day for the period from 19 July through 19 September 1996. Usage from this source is typically less than one-third of the quantity received from Amfac Sugar-Kauai. The maximum daily delivery capacity of water from the Amfac Sugar-Kauai is 1,090,195 liters (288,000 gallons) per day. The amount of water provided to PMRF from the county is limited to 310,403 liters (82,000 gallons) per day. (Hironaka, 1997, 13 Jan, p.1)

Kauai Board of Water Supply water comes from high-level water tunnels above the Mana Plain. It is stored in two 476,960-liter (126,000-gallon) tanks at Kokole Point and serves the southern portions of the base.

3.4.7 LAND USE

Region of Influence

The ROI for land use includes the main base complex.

Affected Environment

PMRF's land use management program is established in the Master Plan (U.S. Department of the Navy, 1990, Oct, p.A-1 through JJ-1). The plan is intended to improve the effectiveness and efficiency of land use and to minimize conflicts. The plan also addresses the need to protect essential mission activities from encroachment, and to protect the human and natural environments.

The dominant land use on PMRF, in terms of area, is the explosive safety and airfield clear zones, which cover 39 percent of the base. Facilities located within these two zones include ordnance magazines, ordnance and weapons operating and support buildings, runways, taxiways, and support structures.

Operational areas are located throughout the base. The rocket launch, Department of Energy, and underground fuel storage areas are located to the north. In the central portion of the station is the Air Operations Area. Communication antenna fields are located to the south. Combined, the operational areas total approximately 136 hectares (335 acres).

Supply and maintenance areas are located adjacent to the flightline in the main base and also adjacent to the operation area in the northern portion of the base. Administration and personnel support areas are located in the main station and the southern portions, respectively. These areas provide space for family housing, administration, bachelor housing, utilities, exchange retail, and recreation facilities.

According to the State Land Use Classification, PMRF-Main Base is located within a conservation district. Conservation districts are managed by the Hawaii DLNR. However, as PMRF-Main Base is a Federal facility, State and local land laws are preempted. Land within PMRF is not designated as agricultural land. PMRF is surrounded by Polihale State Park to the north, Amfac Sugar-Kauai sugar cane fields to the east, a landfill to the south, and the Pacific Ocean to the west. Currently, there are no land use conflicts with the surrounding land.

3.4.8 VISUAL AND AESTHETIC RESOURCES

Region of Influence

The ROI for visual resources includes the Main Base complex and adjacent areas.

Affected Environment

Visual. The physical setting of the area is coastal plain (Mana Plain), coastal dunes, and cliffs. The majority of the terrain within this area is relatively flat, except for the coastal dunes found in Polihale State Park and PMRF and the cliffs along the eastern boundary. The elevation within the area ranges from sea level to 7.6 meters (25 feet) within the coastal plain, to coastal dunes reaching elevations of 30.5 meters (100 feet), and then to the cliffs reaching elevations of 244 meters (800 feet). Given the flat topography of the Mana Plain, prominent vistas and overlooks and views of the ocean are limited. The most visible landscape features are the cliffs on the eastern side of the Mana Plain and the

Nohili Dunes on northern PMRF. The natural visual setting on the Mana Plain was altered by the development of sugar cane and the draining of the marshes. This visual setting was further altered by the development of PMRF.

PMRF is bordered by Polihale State Park to the north, by sugar cane fields on the east, the county landfill to the south, and by the Pacific Ocean on the west. The dunes on the north end of PMRF are the highest natural feature on the base, reaching elevations of about 30.5 meters (100 feet). The Barking Sands dunes have been designated by Kauai County as a Scenic Ecological Area because of the native vegetation and visibility in an otherwise flat landscape. The dunes are covered with thick kiawe which in some places forms a closed canopy of up to 7.6 meters (25 feet) high. The understory, when present, is made up largely of grasses. The sugar cane fields to the east of PMRF provide various stages of growth and can be very tall, which can obstruct views of the surrounding area from public roads or can provide a view of empty fields. Along State Highway 50, telephone poles alter the visual environment but do not obstruct views on either side of the highway.

Besides the dunes in northern PMRF, the remainder of the base is relatively flat and consists mostly of non-native vegetation or a man-made environment of roads, mission-related buildings, and fences. Most of PMRF is effectively screened from public view by vegetation along the eastern and southern boundaries and by the sand dunes to the north. However, PMRF facilities can be viewed by the public from State Highway 50 (Polihale State Park access) if there is no developed sugar cane in the fields adjacent to the base. These facilities include a radar unit, control tower, and miscellaneous facilities along the main base entrance. In addition, a communication tower on southern PMRF is visible from the State Highway. Facilities on PMRF do not obstruct any public views of the cliffs on the eastern side on the Mana Plain or the Nohili Dunes.

Public access to PMRF beaches is allowed during certain periods of the day. The beaches have been maintained in a natural setting, with vegetation along the eastern boundary of the beaches effectively blocking the view of the developed base. (U.S. Army Space and Strategic Defense Command, 1993, Oct, p.16-17)

3.4.9 WATER RESOURCES

Region of Influence

The ROI includes the water resources within and surrounding the property boundaries.

Affected Environment

Surface Water. The surface water within the PMRF boundary is in the canals that drain the agricultural areas east of the PMRF. Apart from these drainages, the rain sinks into the permeable sand so that no surface drainage has been established. There are numerous drains and several irrigation ponds in the agricultural land.

The waters in the irrigation ponds generally do not meet drinking water standards for chloride salts, but have near neutral to slightly alkaline pH. The water in the southern half

of PMRF-Main Base is expected to have similar chemical characteristics. Because the drainage ditches are designed to move water away from the agricultural fields during irrigation and rainfall, and to leach salts from the soil, no residual effects of past launches are expected. (U.S. Army Program Executive Office, 1995, May, p.3-20)

The overlying sediments act as a caprock because of their overall low permeability, although individual layers, such as buried fossil coral reefs, may be as permeable as the basalt. Although the sediments are saturated, they are not exploitable as an aquifer because of unfavorable hydraulic characteristics. The groundwater in the sediments originates as seepage from irrigation percolation and rainfall in the basalt aquifer, especially where the sediments are thin near the inland margin of the Mana Plain.

Groundwater. Bedrock, alluvium, and sand dunes make up hydraulically connected aquifers within the ROI. The bedrock (basement volcanics, primarily basalt) is highly permeable, containing brackish water that floats on seawater. (U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-7)

The dune sand aquifer on which PMRF-Main Base lies has a moderate hydraulic conductivity and moderate porosity of about 20 percent. It consists of a lens of brackish groundwater that floats on seawater and is recharged by rainfall and by seepage from the underlying sediments. The only record of an attempt to exploit this groundwater is of a well drilled for the Navy in 1974, 6.4 to 8 kilometers (4 to 5 miles) south of the Kauai Test Facility. The well was drilled to a depth of 12.8 meters (42 feet), and tested at 1,135.6 liters (300 gallons) per minute. In 1992, the water was too brackish for plants and animals to consume, and consequently, the well is not used. (U.S. Army Program Executive Office, 1995, May, p.3-20)

The nearest fresh groundwater sources are in the Napali formation at the inland edge of the coastal plain along the base of the Mana cliffs. Groundwater in the region is generally considered to be potable at the base of the cliffs, increasing in salinity closer to the coast. (U.S. Army Space and Strategic Defense Command, 1993, Oct, p.3-8)

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4.0 Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

This section of the EA examines potential environmental consequences associated with the Proposed Action. Potential impacts are assessed by comparing proposed program activities with potentially affected environmental components. The amount of detail presented in each section is proportional to the potential for impacts.

4.1 PMRF-KOKEE

4.1.1 AIRSPACE

Potential airspace impacts (i.e., interference with aeronautical operations in the navigable airspace) from implementation of the Proposed Action arise from two distinct effects: (1) the need to segregate nonparticipating aircraft from program activities and (2) the need to advise nonparticipating aircraft to avoid the tracking radar areas and the associated EMR emissions. Potential impacts to Special Use Airspace, en route airways and jet routes, and local airports and airfields are discussed below and in appendix D.

Special Use Airspace

No new special use airspace proposal, or any modification to the existing Special Use Airspace, is contemplated to accommodate proposed program activities. Program activities would continue to utilize the existing over-water Special Use Airspace, namely Restricted Area R-3101 and Warning Area W-188. Although the nature and intensity of utilization varies over time and by individual operational area, the proposed activities do not represent a direct adverse impact on Special Use Airspace. Rather, they represent precisely the kinds of activities for which Special Use Airspace was created—to accommodate national security and necessary military activities and to confine or segregate activities considered to be hazardous to nonparticipating aircraft.

En Route Airways and Jet Routes

Program activities would not require a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; neither would they require a visual flight rules operation to change from a regular flight course or altitude. Consequently, no impacts to the surrounding low-altitude airways and/or high-altitude jet routes are identified.

No impacts to the ROI's airways and jet routes are identified because of the required coordination with the FAA. There is a scheduling agency identified for each piece of Special Use Airspace that the PMRF utilizes on a routine basis (most daily, some five days/week, a few on an as-needed basis). Schedules are provided to the FAA facility as

agreed between the agencies involved. Priorities are assigned to different events, and evocation of these priorities often leads to last-minute cancellations of lower-priority events, but transmission of the schedule is still made to the controlling Air Route Traffic Control Center. Real-time airspace management involves the release of airspace to the FAA when the airspace is not in use or when extraordinary events occur that require drastic action, such as weather requiring additional airspace.

The proposed activities would be conducted clear of established oceanic air routes or areas of known surface or air activity and in compliance with DOD Directive 4540.1, AR 95-10, AR 385-62 (U.S. Department of the Army, 1988).

The proposed use of the radar on PMRF-Kokee would necessitate advising non-participating aircraft to avoid the radar areas and the associated EMR emissions. Operation of the radars has the potential for interference with airborne weather radar systems. However, aircraft would still be notified by the issuance of Notices to Airmen to advise avoidance of the tracking radar area during program activities. Moreover, the tracking radar area is likely to be contained within Restricted Area R-3101, which is in use from 6:00 a.m. to 6:00 p.m., Monday through Friday, and Warning Area W-188, which is in use continuously.

The need to advise nonparticipating aircraft to avoid the tracking radar areas and the associated EMR emissions is the second potential airspace use impact on en route airways and jet routes. Operation of the tracking and acquisition radars, or sensors, has the potential for some interference with airborne weather radar systems. Since this has implications for aircraft safety, rather than airspace use as such, it is discussed in more detail in the Health and Safety section below. However, airspace use would still be affected by issuances of Notices to Airmen to advise avoidance of the tracking radar areas during program activities. The tracking radar area is likely to be contained within the W-188 Warning Area.

Airports/Airfields

Proposed activities would continue to utilize the existing Special Use Airspace and would not restrict access to or affect the use of the existing public use airports and airfields. Similarly, existing airfield/airport arrival and departure traffic flows would not be affected. All arriving and departing aircraft to and from the PMRF-Makaha Ridge instrumentation area heliport and all participating military aircraft are under the control of the PMRF-Barking Sands Radar Control Facility; therefore, there are no airfield and/or airport conflicts in the area. Access to the private Kekaha airstrip would not be affected.

Cumulative Impacts

All airspace activities that utilize Special Use Airspace would take place in existing Special Use Airspace that is cleared of nonparticipating aircraft. The W-188 Warning Area Special Use Airspace is also used on an ongoing basis for missile, rocket, and gunnery operational firing. The substantial size of Warning Area W-188 allows the PMRF to schedule

simultaneous operations in different subdivisions. Therefore, adverse cumulative impacts from proposed activities to existing activities can be obviated by range subdivision scheduling.

4.1.2 BIOLOGICAL RESOURCES

Potential issues related to biological resources include vehicle use during activities, increase in human presence, and EMR. If newly listed species are found to occur in the test area, the potential for program activities to affect these species would be evaluated.

Vegetation

A botanical assessment survey of the site conducted for the 1993/1995 MSITP EAs revealed no listed, candidate, or proposed threatened and endangered species, and none of the plants found are considered rare and vulnerable. All of the vegetation within the PMRF-Kokee and PMRF-Makaha Ridge complexes is either ruderal or horticultural landscaping. Changes in the siting of the project at PMRF-Kokee would not otherwise impact any botanical resources because most of the site is paved. It is not anticipated that any changes have occurred at the PMRF-Kokee site since this recent finding.

Wildlife

There have been no reports of birds being affected by EMR from the existing sensors located in the PMRF-Kokee or PMRF-Makaha Ridge complexes. The protection provided by the restricted access, and grassy habitat within Makaha Ridge would continue to have a positive impact on the small endangered Hawaiian goose (*ne ne*) population present in the area (U.S. Department of the Navy, 1998).

Impacts from security lighting associated with the MSSTIC project could cause native birds to become disoriented and injure themselves. Security lighting could disorient the Newell's shearwater that may fly over the sites. U.S. Fish and Wildlife Service approved lighting designed to be deflected downward to minimize the potential for disorientation would be used. Security lighting shall be avoided during the months of October and November, when young Newell's shearwaters leave their mountain burrows and head out to sea. (U.S. Department of the Navy, 1993; 1995)

In terms of the potential for cumulative EMR exposure effects, it is important to note that no Federal standard has yet been promulgated for exposure to electromagnetic fields, let alone wildlife. The Environmental Protection Agency considered power density limits in the range of 0.5 milliwatts per square centimeter (mW/cm^2) to 5 mW/cm^2 , the latter being the same as the U.S. Navy and 1982 American National Standards Institute standard. The American National Standards Institute guidelines, as well as most all microwave protection guides, are based on the time-average value of exposure, i.e., the value of power density when averaged over any 6-minute period. Thus, while 5 mW/cm^2 is permitted for 6 minutes or greater, the so-called continuous limit, higher values are acceptable if the exposure time can be limited to less than 6 minutes. For example, if the

exposure time is only 3 minutes long, then 10 mW/cm² is acceptable; if the exposure duration is only 1 minute, then 30 mW/cm² would be acceptable. (U.S. Department of the Navy, 1998)

The concept of time averaging is important in consideration of the potential cumulative exposures that might occur near operating radars. Because tracking and searching radar beams move rapidly, it is very unlikely that environmental exposures will ever consist of continuous, constant values of power density. Rather, exposures will be intermittent and, when the radars are transmitting, the electromagnetic fields would be constantly changing in intensity. Thus, the potential for additive, incremental cumulative impacts from EMR exposure is extremely limited. Exposure analyses that do not take into account the fact that the radar beams will be almost constantly moving about will generally significantly overestimate the actual power densities that would occur during normal operations. (U.S. Department of the Navy, 1998)

No negative impacts are anticipated to native birds as the result of radar beams because the power density of the RSTER will be below the threshold to cause harm to birdlife and the radar will only be illuminated in an 205° arc from 145° clockwise to 350° True, centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Birds also are not expected to remain in the radar beam long enough to be adversely affected by EMR. Human activity may temporarily disturb non-listed terrestrial species, but this disturbance is expected to be temporary.

Impacts on biological resources associated with any incremental increase in the use of radars and other communication instrumentation would be negligible.

Cumulative Impacts

As discussed above, the potential for additive, incremental cumulative impacts from EMR exposure is extremely limited. No cumulative impacts to biological resources are expected as a result of proposed activities.

4.1.3 HEALTH AND SAFETY

Potential issues related to health and safety include EMR effects on personnel and the public as a result of the Proposed Action. To minimize these hazards, the MSSTIC facility program would be conducted in accordance with all relevant and appropriate regulations, procedures, and policies.

Prior to installation of any new radar or telemetry unit, the Navy conducts an EMR hazard review that considers hazards of EMR on personnel, fuel, and ordnance (see appendix D). The review provides recommendations for sector-blanking and safety systems to minimize HERP, HERF, and HERO exposures. During the majority of the tests, the radar units would transmit at a frequency of 435 megahertz. Some tests may require other frequencies between 400 and 500 megahertz. Additional electromagnetic compatibility studies would

be performed prior to the use of frequencies that have not been used before at the test sites. The peak power of the planned tests would be up to 140 kW at PMRF-Kokee and 500 kW at PMRF-Makaha Ridge.

A perimeter rope with caution and radiation warning signs would restrict access within 6 meters (20 feet) of the tower during periods of operation. A blue oscillating warning beacon would also be lighted when the radar is operating. A fail-safe system would be implemented to ensure that personnel from one project are never aloft and working on their equipment when another project is radiating. The proposed systems would have the appropriate safety exclusion zones established prior to operation, and each unit would have warning lights to inform personnel when the system is emitting EMR. These systems would be located on PMRF-Kokee and PMRF-Makaha Ridge and would not represent a public health and safety risk. The proposed systems would be similar to existing systems used at the sites. In addition, the location of Makaha Ridge at the end of a cliff further minimizes public exposure risk to EMR.

Electromagnetic radiation poses a health threat to people within its beam. To obviate this threat, all civilian and base personnel would be excluded from the EMR hazard area during radar operations. As identified in Army Environmental Hygiene Agency (1987) guidelines, the radiation hazard zone would be indicated by warning signs, and a warning beacon would be illuminated when the radar is operating to keep all personnel out of this area.

Overall, there would be no adverse health and safety risks as a result of implementation of the Proposed Action.

Cumulative Impacts

In terms of cumulative impacts, the addition of the radar units would be sited such that appropriate HERP distances are established and personnel do not enter these areas during radar operations. Because personnel are outside of EMR exposure areas, no cumulative exposures would occur.

4.1.4 INFRASTRUCTURE

Water

It is anticipated that a temporary personnel force of approximately nine would require 1,635 liters (432 gallons) of potable water per day. This water requirement is small and within the existing capacity. The park is drilling a new well that should be on-line within 1 to 2 years. This new well will have a capacity of 151 liters (40 gallons) per minute (218,039 liters [57,600 gallons] per day) and will have a depth of approximately 46 meters (150 feet). The new well would minimize the ongoing demands for water resources in the area. (U.S. Department of the Navy, 1998)

Cumulative Impacts

In terms of cumulative impacts, the Proposed Action would result in a continuation of the water supply problems currently at Kokee; however, the proposed new well would reduce the significance of any water demand impacts.

4.1.5 LAND USE

Under the Proposed Action, the existing radars would continue to be used, and new radars would be located at PMRF-Kokee within the existing government leased land. The surrounding uses are compatible with the PMRF-Kokee site. The additional facilities would be located within the complex and would not affect the offsite land uses. Under the Proposed Action, operations at PMRF-Kokee would be compatible with the surrounding land uses and zoning. The EMR generated by the proposed and existing site radar units would not affect adjacent land uses. Overall, no adverse impacts to land use would occur from implementation of the Proposed Action.

The activities at Kokee under the Proposed Action would be consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program.

Cumulative Impacts

In terms of the potential for cumulative impacts, although facilities would be reinstalled under the Proposed Action, these facilities would be located within the existing developed PMRF-Kokee site and would not change any existing land uses; therefore, no cumulative impacts would occur.

4.1.6 VISUAL AND AESTHETIC RESOURCES

The proposed antenna/pedestal at the PMRF-Kokee site will be visible for a distance of about 90 meters (100 yards) between the 14-mile and 15-mile markers along Highway 550 traveling in a downhill direction. However, given the existing visual environment (a currently visible existing 9-meter [30-foot] antenna/pedestal and prominent utility poles and lines along Highway 550), and the fact that the structures are only visible momentarily from the road in a moving vehicle, the impacts of the MSSTIC facility would be minimal.

The UESA antenna is flat in profile, presenting less vertical surface area than the previously tested RSTER-90. Therefore, its use will impose less visual impact than the RSTER-90. It will therefore be less imposing when viewed from Highway 550 and Waimea Canyon lookout. Hikers in the canyon will have a steeper view plane than from the lookout, allowing them an opportunity to view the antenna's horizontal bulk. However, they will also be further away, and the intervening trees and topographic features will obscure the tower/antenna. The antenna/tower will not be visible from any beach because of view planes, nor will it be visible by boaters because of distance. The tower will be an open lattice structure that will reduce the visual perception of structural

bulk. Based on past experience with the Very Long Baseline Interferometry Radio Telescope, the use of camouflage was determined to be of questionable value. The tower will be galvanized steel that oxidizes to a dull gray finish, thus reducing reflectivity. To further minimize visual impacts, existing white buildings will be painted dark brown.

Cumulative Impacts

Development of sugar cane, Federal government facilities, utility corridors, and State Park facilities has altered the visual environment in the region. However, most of the views along the Kaumualii Highway still present a natural setting, and no views of Waimea Canyon have been obstructed. No other development occurs along this section of the Na Pali Coast, and no other development is planned; therefore, there would be no cumulative impacts to the visual environment.

4.2 PMRF-MAKAHA RIDGE

4.2.1 AIRSPACE

Potential impacts from operating the radars on PMRF-Makaha Ridge would be as discussed for PMRF-Kokee above and in appendix D.

Special Use Airspace

No new special use airspace proposal, or any modification to the existing Special Use Airspace, is contemplated to accommodate proposed program activities.

En Route Airways and Jet Routes

Program activities would not require a change to an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure; neither would they require a visual flight rules operation to change from a regular flight course or altitude. Consequently, no impacts to the surrounding low-altitude airways and/or high-altitude jet routes are identified.

The proposed use of the radar on PMRF-Makaha Ridge would require the continuance of advising non-participating aircraft to avoid the radar areas and the associated EMR emissions.

Airports/Airfields

Proposed activities would continue to utilize the existing Special Use Airspace and would not restrict access to or affect the use of the existing public use airports and airfields. Similarly, existing airfield/airport arrival and departure traffic flows would not be affected. All arriving and departing aircraft to and from the PMRF-Makaha Ridge instrumentation

area heliport and all participating military aircraft are under the control of the PMRF-Barking Sands Radar Control Facility; therefore, there are no airfield and/or airport conflicts in the area. Access to the private Kekaha airstrip would not be affected.

Cumulative Impacts

All airspace activities that utilize Special Use Airspace would take place in existing Special Use Airspace that is cleared of nonparticipating aircraft. The W-188 Warning Area Special Use Airspace is also used, on an ongoing basis, for missile, rocket, and gunnery operational firing. The substantial size of Warning Area W-188 allows PMRF to schedule simultaneous operations in different subdivisions. Therefore, adverse cumulative impacts from proposed activities to existing activities can be obviated by range subdivision scheduling.

4.2.2 BIOLOGICAL RESOURCES

Potential issues related to biological resources are discussed above in section 4.1.2.

Vegetation

A botanical assessment survey of the site conducted for the 1993/1995 MSITP EAs revealed no listed, candidate, or proposed threatened and endangered species, and none of the plants found are considered rare and vulnerable. All of the vegetation within the PMRF-Makaha Ridge complex is either ruderal or horticultural landscaping.

Wildlife

There have been no reports of birds being affected by EMR from the existing sensors located in the PMRF-Makaha Ridge complex. The protection provided by the restricted access, and grassy habitat within Makaha Ridge would continue to have a positive impact on the small endangered Hawaiian goose (ne ne) population present in the area (U.S. Department of the Navy, 1998).

Impacts from security lighting associated with the MSSTIC project are discussed above in section 4.1.2.

No negative impacts are anticipated to native birds as the result of radar beams because the power density of the RSTER will be below the threshold to cause harm to birdlife. The program requires 24-hour access to a sector from 145° clockwise to 350° True, centered on the PMRF-Makaha Ridge and extending 370 kilometers (200 nautical miles). Birds also are not expected to remain in the radar beam long enough to be adversely affected by EMR. Human activity may temporarily disturb non-listed terrestrial species, but this disturbance is expected to be temporary.

Impacts on biological resources associated with any incremental increase in the use of radars and other communication instrumentation would be negligible. The small population of the Hawaiian goose (ne ne) will not be adversely affected by the activities associated with the Proposed Action.

Cumulative Impacts

As discussed above, the potential for additive, incremental cumulative impacts from EMR exposure is extremely limited. No cumulative impacts to biological resources are expected as a result of proposed activities.

4.2.3 HEALTH AND SAFETY

Potential impacts from EMR are discussed above in section 4.1.3 and in appendix D. The proposed systems located on PMRF-Makaha Ridge would not represent a public health and safety risk. The proposed systems would be similar to existing systems used at the sites. In addition, the location of Makaha Ridge at the end of a cliff further minimizes public exposure risk to EMR.

Overall, there would be no adverse health and safety risks as a result of implementation of the Proposed Action.

Cumulative Impacts

In terms of cumulative impacts, the addition of the radar units would be sited such that appropriate HERP distances are established and personnel do not enter these areas during radar operations. Because personnel are outside of EMR exposure areas, no cumulative exposures would occur.

4.2.4 INFRASTRUCTURE

Water

It is anticipated that a temporary personnel force of approximately nine would require 1,635 liters (432 gallons) of potable water per day. This water requirement is small and within the existing capacity. The park is drilling a new well that should be on-line within 1 to 2 years. This new well will have a capacity of 151 liters (40 gallons) per minute (218,039 liters [57,600 gallons] per day) and will have a depth of approximately 46 meters (150 feet). The new well would minimize the ongoing demands for water resources in the area. (U.S. Department of the Navy, 1998)

Cumulative Impacts

In terms of cumulative impacts, the Proposed Action would result in a continuation of the current water supply problems; however, the proposed new well would reduce the significance of any water demand impacts.

4.2.5 LAND USE

As part of the Proposed Action, PMRF-Makaha Ridge would continue to be used by PMRF to support range tracking. The military uses and safety zones associated with PMRF-Makaha Ridge are compatible with the existing open uses that surround the facility. The use of the facility does not conflict with the management of the Puu Ka Pele Forest Reserve. In addition, the use of PMRF-Makaha Ridge is compatible with the State conservation use district that limits surrounding development. The EMR generated by the site radar units would not affect adjacent land uses.

Within the PMRF-Makaha Ridge complex, the use of the proposed facilities is associated with military tracking functions and is compatible with the site. Overall, no impacts would result to land use from the Proposed Action.

The continuation of activities at PMRF-Makaha Ridge would be consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program. Activities at Makaha Ridge do not affect any recreational opportunities.

Cumulative Impacts

In terms of the potential for cumulative impacts, facilities would be located within the existing developed PMRF-Makaha Ridge site and would not change any existing land uses; therefore, no cumulative impacts would occur.

4.2.6 VISUAL AND AESTHETIC RESOURCES

Under the Proposed Action, there would be no change to the visual environment on Makaha Ridge. As described in the affected environment, the site is not visible from Highway 550, the main public road in the area, and the facility does not obstruct any prominent vistas. The facility can be viewed by watercraft traveling the ocean approximately 445 meters (1,460 feet) below the facility and by hunters using the Puu Ka Pele Forest Preserve. This view of Makaha Ridge does not result in any adverse impacts.

Cumulative Impacts

Development of sugar cane, Federal government facilities, utility corridors, and State Park facilities has altered the visual environment in the region. However, most of the views along the Kaumualii Highway still present a natural setting, and no views of Waimea Canyon have been obstructed. No other development occurs along this section of the Na Pali Coast, and no other development is planned; therefore, there would be no cumulative impacts to the visual environment.

4.3 PMRF-MAIN BASE

4.3.1 AIR QUALITY

Air quality impacts could occur during construction associated with the Proposed Action. Intermittent impacts could result from fugitive dust (particulate matter) and construction equipment emissions. A conservative estimate for uncontrolled fugitive dust emissions from ground disturbing activities is 1.08 metric tons (1.2 tons) per acre per month of activity (U.S. Environmental Protection Agency, 1995). Normally, half of these emissions are assumed to be PM-10; however, the precise fraction depends upon the makeup of the local soil. Construction vehicles and equipment would generate combustion emissions.

The air quality impacts would be localized and would only occur when construction activities were actually being conducted. No unusual amounts or types of air emissions would be anticipated due to construction. Standard dust reduction measures, such as wetting disturbed soils, would be implemented. Vehicles would also be turned off when not in use.

The building would run off commercial power and, if required, PMRF would supply backup power from existing on-base generators. No amendments to PMRF's Title V would be required. No impacts to air quality are expected.

Cumulative Impacts

Air quality impacts would be localized and would only occur when construction activities were actually being conducted. No cumulative impacts are expected.

4.3.2 BIOLOGICAL RESOURCES

Potential impacts on biological resources at PMRF/Main Base would be caused by ground clearance at proposed sites resulting in vegetation removal, habitat loss, and disturbance of wildlife. In addition, construction noise and the activity of increased personnel present could affect some threatened or endangered wildlife species that use the ponds and drains adjacent to the PMRF/Main Base or the drains that cross the base to the ocean.

Construction activities in the sand dune area within the base boundary have the potential to impact *Sesbania tomentosa* and *Panicum niihauensis*, two federally listed endangered species, although these species have not been observed in that area of the dunes. Similar impacts on biological resources have been addressed in the Strategic Target System EIS documentation (U.S. Army Strategic Defense Command, 1992, Feb, p.4-22 through 4-30). The adder's tongue fern, which the Strategic Target System EIS indicated could be affected by construction activities, is no longer a protected species. The Laysan albatross was also discussed as being potentially affected by construction activities. However, since there is an ongoing program to discourage them from nesting on PMRF, under USFWS permit, they will not be affected by construction relating to the Proposed Action. Any outdoor lighting associated with construction activities will be properly shielded,

following U.S. Fish and Wildlife Service guidelines, so as not to attract Newell's shearwaters.

Cumulative Impacts

The activities proposed for PMRF-Main Base should have negligible cumulative impacts on biological resources since most biological habitats support non-native and non-sand dune vegetation.

4.3.3 CULTURAL RESOURCES

An undertaking is considered to have an effect on a historic property when it may alter characteristics of the property that may otherwise qualify the property for inclusion in the National Register. An effect is considered to be adverse when it diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include but are not limited to:

- The physical destruction, damage, or alteration of all or part of the property
- Isolation of the property from, or alteration of the character of, the property's setting when that character contributes to the property's qualification for the National Register
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting
- Neglect of a property resulting in its deterioration or destruction
- Transfer, lease, or sale of the property (36 CFR 800.9 b)

Construction-related activities may include ground-clearing, subsurface excavation disturbances, construction-related vibrations, and a potential for increased vehicular traffic.

Potential impacts to cultural resources could also result from an increase of construction and operations support personnel at these proposed locations. The potential for unauthorized removal impacts would be manifested through the disturbance of historical properties and/or archaeological and historic resources. An inventory survey was performed on 20 January 2000 in the area proposed for the facility support buildings, to determine the presence of cultural resources. No significant resources were located, and the conclusion of the survey was that no further action is needed. However, limited archaeological monitoring will be performed. (Anderson, 2000)

The Navy and the SHPO signed a Memorandum of Agreement for cultural resource management for all PMRF activities in January 1999. The Advisory Council on Historic Preservation signed the Memorandum of Agreement in March 1999. Through the implementation of the appropriate monitoring, consultations with SHPO Hawaii, and by following U.S. Navy and PMRF's Integrated Cultural Resources Management Plan, adverse

impacts to cultural resources would be reduced and/or eliminated at the locales under consideration.

Cumulative Impacts

Cumulative impacts to cultural resources under the Proposed Action could result from an increased presence of personnel resulting in the incidental unauthorized removal of cultural materials and/or destruction of sites due to increase vehicular (recreational and operations related) traffic along shoreline and sand dunes in these areas. However, through the implementation of the appropriate monitoring, consultations with SHPO Hawaii, and by following U.S. Navy and PMRF's Integrated Cultural Resources Management Plan, adverse cumulative impacts to cultural resources would be reduced and/or eliminated at the locales under consideration.

4.3.4 GEOLOGY AND SOILS

The Proposed Action includes new construction of support facilities in the southern portion of PMRF-Main Base. No adverse impacts to soils are likely to occur as a result of new construction because the proposed site is located in modern alluvial and dune sands unsuitable for agricultural development. Soil disturbance would be limited to the immediate vicinity of the proposed construction. New construction will be of short duration. Soils at the construction site may be subject to minor erosion from the wind during the construction period. Best Management Practices, such as frequent watering of excavated material and/or the use of soil additives to bond exposed surface soils, would reduce the potential for soil erosion.

Cumulative Impacts

Soil disturbance would be limited to the immediate vicinity of the proposed construction and new construction would be of short duration. No cumulative impacts to geology and soils are expected.

4.3.5 HEALTH AND SAFETY

Construction of new facilities would be conducted in accordance with the Corps of Engineers Safety and Health Requirements Manual. Construction of new facilities is routinely accomplished for both military and civilian operations and presents only occupational related effects on safety and health for workers involved in the performance of the construction activity. The siting would be in accordance with DOD standards taking into account facility compatibility issues.

Cumulative Impacts

Since siting of the new construction and the actual construction activities would be in accordance with DOD standards, no cumulative impacts are expected.

4.3.6 INFRASTRUCTURE

An addition of 9 to 12 personnel would result in only a slight increase in demand for electricity, solid waste disposal, wastewater treatment, and potable and non-potable water. The electrical system is adequate to provide this increase in electricity. The potential increase in solid waste would not result in impacts since the County intends to implement plans to meet future refuse requirements. No impacts are anticipated because of an increased demand for wastewater treatment since the system currently is operating at only 37 percent of its capacity. The amount of water required would be within the capacity of the current water system, and no impacts are expected.

Cumulative Impacts

No cumulative impacts to the infrastructure system of PMRF-Main Base are anticipated.

4.3.7 LAND USE

Siting and use of the proposed areas would be conducted in accordance with DOD and Navy criteria, taking into account ESQD and EMR safety criteria. No new ground hazard areas would be created, and the maximum time of activation of the restrictive easement would not increase beyond the current agreement with the State. The activities at PMRF under the Proposed Action would be consistent to the maximum extent practicable with the Hawaii Coastal Zone Management Program. Overall, no adverse impacts would occur to land use and recreation from implementation of the Proposed Action.

Cumulative Impacts

Construction of proposed facilities would not change any existing land uses, and no cumulative impacts are expected.

4.3.8 VISUAL AND AESTHETIC RESOURCES

These new facilities would be located near existing operational facilities and would not provide an out-of-character element.

Cumulative Impacts

Development of sugar cane, Federal government facilities, utility corridors, and State Park facilities has altered the visual environment in the region. No cumulative impacts are expected.

4.3.9 WATER RESOURCES

The building modifications and new construction would follow standard methods to control erosion during construction. The topography and permeability of the soils would also limit the potential for impacts to water resources from construction activities.

Since all activities would follow Spill Prevention, Control, and Countermeasures Plans, and transportation safety measures, potential impacts to surface and groundwater resulting from accidental spills of hazardous materials would be minimized.

Cumulative Impacts

No cumulative impacts to water resources are anticipated.

4.4 INDIRECT EFFECTS OF THE PROPOSED ACTION

No indirect effects are expected as a result of the MSSTIC Facility program due to the small number of temporary personnel required and limited scope of activities.

4.5 ENVIRONMENTAL CONSEQUENCES OF THE NO-ACTION ALTERNATIVE

If the No-action Alternative is selected, no environmental consequences associated with reinstalling equipment at PMRF-Kokee and the additional use of equipment at PMRF-Makaha Ridge are anticipated. The additional construction required for this program would not occur on PMRF-Main Base. Current and other proposed activities would continue at these locations.

4.6 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

Adverse environmental effects that cannot be avoided include the release of small amounts of pollutants into the atmosphere and the ocean, and minor noise impacts on wildlife.

4.7 CONFLICTS WITH FEDERAL, STATE, AND LOCAL LAND USE PLANS, POLICIES AND CONTROLS FOR THE AREA CONCERNED

The proposed program activities at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base would be consistent with the existing land use. PMRF maintains federal jurisdiction for on-base land use; therefore, state and local land use laws are preempted.

4.8 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL

Anticipated energy requirements of each program activity would be within the energy supply capacity of the installation. Energy use requirements would be subject to any established energy conservation practices.

4.9 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Although the proposed activities would result in some irreversible or irretrievable commitment of resources such as various metallic materials, minerals, fossil fuels, and labor, the amount of materials and energy required for any Proposed Action-related activities would be small.

4.10 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENTAL AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have been and are currently being used for sensor test and development. The Proposed Action does not eliminate any options for future use of the environment for the locations under consideration.

4.11 FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS (EXECUTIVE ORDER 12898)

The Proposed Action would be conducted in a manner that would not substantially affect human health or the environment. The EA has identified no effects that would result in a disproportionately high or adverse effect on minority or low-income populations in the area. The activities would also be conducted in a manner that would not exclude persons from participation in, deny persons the benefits of, or subject persons to discrimination under the program because of their race, color, or national origin.

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8.0 REFERENCES

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Appendix A
Environmental Resources, Applicable Laws and
Regulations, and Compliance Requirements

APPENDIX A

ENVIRONMENTAL RESOURCES,

APPLICABLE LAWS AND REGULATIONS,

AND COMPLIANCE REQUIREMENTS

The following Federal environmental laws and regulations were reviewed to assist in determining the significance of environmental impacts under the National Environmental Policy Act (NEPA).

Air Quality

The Clean Air Act seeks to achieve and maintain air quality to protect public health and welfare (42 United States Code [USC] 7401 et seq.). To accomplish this, Congress directed the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS). Primary standards protect public health; secondary standards protect public welfare (e.g., vegetation, property damage, scenic value). NAAQS address six criteria pollutants: carbon monoxide, nitrogen oxides, lead, sulfur dioxides, ozone, and particulates.

Primary responsibility to implement the Clean Air Act rests with each state. However, each state must submit a state implementation plan (SIP) outlining the strategy for attaining and maintaining the NAAQS within the deadlines established by the act. If the state does not provide a SIP that is acceptable to the EPA, the EPA will provide a SIP which the state is then required to enforce.

The Clean Air Act mandates establishment of performance standards, called New Source Performance Standards, for selected categories of new and modified stationary sources to keep new pollution to a minimum. Under the act, the EPA can establish emission standards for hazardous air pollutants for both new and existing sources. So far, the EPA has set National Emission Standards for Hazardous Air Pollutants (NESHAP) for beryllium, mercury, asbestos, vinyl chloride, and other hazardous materials including radioactive materials.

The Clean Air Act also seeks to prevent significant deterioration of air quality in areas where the air is cleaner than that required by the NAAQS. Areas subject to prevention of significant deterioration regulations have a Class I, II, or III designation. Class I allows the least degradation.

Nonattainment policies also exist. A nonattainment area is one where monitoring data or air quality modeling demonstrates a violation of the NAAQS. The most widespread violation of the NAAQS is related to ozone. For ozone, urban areas are sorted into five categories: marginal, moderate, serious, severe, and extreme. Additionally, stratospheric ozone and climate protection policies have been established. Interim reductions in the

phaseout of chlorofluorocarbons, methyl chloroforms, and halons have been mandated. Hydrochlorofluorocarbons must be phased out of production beginning in 2015, with production elimination set for 2030. State and local governments are required to implement policies that prevent construction or modification of any source that will interfere with attainment and maintenance of ambient standards. A new source must demonstrate a net air quality benefit. The source must secure offsets from existing sources to achieve the air quality benefit.

The Clean Air Act Amendments of 1990 represent the first significant revisions to the Clean Air Act in the past 13 years (42 USC 7401 et seq.). The amendments strengthen and broaden earlier legislation by setting specific goals and timetables for reducing smog, airborne toxins, acid rain, and stratospheric ozone depletion over the next decade and beyond.

The Clean Air Act Amendments of 1990 contain 11 major titles which address various issues of the National Air Pollution Control Program. Title I, Attainment and Maintenance of National Ambient Air Quality Standards, mandates technology-based emissions control for new and existing major air pollution sources. Title II, Mobile Sources, deals with emissions control for motor vehicles in the form of tailpipe standards, use of clean fuels, and mandatory acquisition of clean-fuel vehicles. Hazardous Air Pollutants, Title III, mainly addresses the control of hazardous air pollutants (HAPs) and contingency planning for the accidental release of hazardous substances. There are 189 HAPs identified in the new amendments. Title IV, Acid Rain, focuses on the reduction of sulfur dioxide and nitrogen oxides in the effort to eliminate acid rain. Permits, Title V, establishes a nationwide permit program for air pollution sources. The permits will clarify operating and control requirements for affected stationary sources. Stratospheric Ozone Protection, Title VI, restricts the production and use of chlorofluorocarbons, halons, and other halogenated solvents which, when released into the atmosphere, contribute to the decomposition of stratospheric ozone. Title VII, Enforcement, describes civil and criminal penalties which may be imposed for the violation of new and existing air pollution control requirements. Title VIII of the 1990 amendments contains various miscellaneous provisions concerning the outer continental shelf, international border areas, grants, secondary standards, renewable energy incentives, and visibility. Information and rules related to clean air research can be found in Title IX. The EPA is to conduct studies on improved methods and techniques for measuring individual air pollutants, health effects associated with exposure to air pollutants, improvements in predictive models and response technology for accidental releases of dense gas, acid precipitation, clean fuels, and improved studies on the ecosystem, among others. Title X requires that a certain percentage of Federal funds, set aside for research required under the act, be made available to disadvantaged businesses. Title XI contains laws pertaining to Clean Air Employment Transition Assistance. Topics covered in this title include the Job Partnership Training Act provisions, funding, benefits, and eligibility requirements.

New or modified major sources in attainment areas would also be subject to Prevention of Significant Deterioration (PSD) review as presented in 40 CFR 51.166 in order to ensure the continued maintenance of a high air quality baseline standard. Emissions from new or

modified major sources are controlled using Best Available Control Technology. Geographical areas are ranked into three categories for purposes of PSD. Class I areas are those areas where any appreciable deterioration of air quality would be considered significant. These areas include certain national parks and wilderness areas. Class II is the default classification. Class II areas can allow for moderate, well-controlled industrial growth. Under certain circumstances, states may reclassify areas as Class III. These areas allow for greater industrial development. The overall air quality impacts due to the source in question in combination with other PSD sources in the area must not exceed the area's allowable incremental increases identified in table A-1. Concentrations of particulate pollutants resulting from construction or other temporary emission-related activities of new or modified sources are specifically excluded from determining the portion of the increment consumed.

Table A-1: Permissible PSD Incremental Increase (by Area Classification)

Pollutant	Averaging Time	Maximum Allowable Increase (micrograms per cubic meter)		
		Class I	Class II	Class III
Nitrogen dioxide	Annual	2.5	25	50
Sulfur dioxide	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
PM ₁₀	Annual	4	17	34
	24-hour	8	30	60

Source: 40 CFR 51.166, revised as of July 1, 1995

Airspace – The Federal Aviation Act of 1958 gives the Federal Aviation Administration (FAA) sole responsibility for the safe and efficient management of all airspace within the continental United States, a responsibility that must be executed in a manner that meets the needs of all airspace users, both civil and military. The FAA's policy on airspace is implemented by FAA Order 1000.1A and is stated in FAA Handbook 7400.2C, Procedures for Handling Airspace Matters, as follows:

The navigable airspace is a limited national resource, the use of which Congress has charged the FAA to administer in the public interest as necessary to insure the safety of aircraft and the efficient utilization of such airspace. Full consideration shall be given to the requirements of national defense and of commercial and general aviation and to the public right of freedom or transit through the airspace. Accordingly, while a sincere effort shall be made to negotiate equitable solutions to conflicts over its use for non-aviation purposes, preservation of the navigable airspace for aviation must receive primary emphasis.

(FAA Order 7400.2C CHG 4 § 1006, 1991)

The FAA regulates military operations in the National Airspace System through the implementation of FAA Handbook 7400.2 and FAA Handbook 7610.4G, Special Military Operations. The latter was jointly developed by the Department of Defense (DOD) and FAA to establish policy, criteria, and specific procedures for air traffic control planning, coordination, and services during defense activities and special military operations.

Part 7 of FAA Handbook 7400.2 contains the policy, procedures, and criteria for the assignment, review, modification, and revocation of special use airspace. Special use airspace, including prohibited areas, restricted areas, military operations areas, alert areas, and controlled firing areas, is airspace of defined dimensions wherein activities must be confined because of their nature and/or wherein limitation may be imposed upon aircraft operations that are not a part of those activities (FAA ORDER 7400.2C CHG 4, 1991).

DOD policy on the management of special use airspace is essentially an extension of FAA policy, with additional provisions for planning, coordinating, managing, and controlling those areas set aside for military use. Airspace policy issues or interservice problems that must be addressed at the DOD level are handled by the DOD Policy Board on Federal Aviation, a committee composed of senior representatives from each service. However, airspace action within the DOD is decentralized, with each service having its own central office to set policy and oversee airspace matters.

Executive Order 10854 extends the responsibility of the FAA to the overlying airspace of those areas of land or water outside the jurisdiction of the United States. Under this order, airspace actions must be consistent with the requirements of national defense, must not be in conflict with any international treaties or agreements made by the United States, nor be inconsistent with the successful conduct of the foreign relations of the United States. Accordingly, actions concerning airspace beyond U.S. jurisdiction (19 kilometers [12 miles]) require coordination with the DOD and State Department, both of which have preemptive authority over the FAA (FAA Order 7400.2C CHG 4, § 1009, 1991).

Part 7 of FAA Handbook 7400.2 contains the policy, procedures, and criteria for the assignment, review, modification, and revocation of special use airspace overlying water, namely, warning areas. A warning area is airspace of defined dimensions over international waters that contains activity which may be hazardous to nonparticipating aircraft. Because international agreements do not provide for prohibition of flight in international airspace, no restriction of flight is imposed. The term "warning area" is synonymous with the International Civil Aviation Organization term "danger area" (FAA Order 7400.2C CHG 4, § 7400, 1991).

Biological Resources

The Endangered Species Act declares that it is the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species (16 USC 1531 et seq.). Further, the act directs Federal agencies to use their authorities in furtherance of the purposes of the act.

Under the Endangered Species Act, the Secretary of the Interior creates lists of endangered and threatened species. The term endangered species means any species which is in danger of extinction throughout all or a significant portion of its range. The act defines a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

A key provision of the Endangered Species Act for Federal activities is Section 7 consultation. Under Section 7 of the act, every Federal agency must consult with the Secretary of the Interior, U.S. Fish and Wildlife Service (USFWS), to ensure that any agency action (authorization, funding, or execution) is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species.

Through the Fish and Wildlife Coordination Act, Congress encourages all Federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and promote conservation of nongame fish and wildlife and their habitats (16 USC 2901 et seq.). Further, the act encourages each state to develop a conservation plan.

The Fish and Wildlife Coordination Act requires a Federal department or agency that proposes or authorizes the modification, control, or impoundment of the waters of any stream or body of water (greater than 4.1 hectares [10 acres]), including wetlands, to first consult with the USFWS. Any such project must make adequate provision for the conservation, maintenance, and management of wildlife resources. The act requires a Federal agency to give full consideration to the recommendations of the USFWS and to any recommendations of a state agency on the wildlife aspects of a project.

Cultural Resources

The Historic Sites Act of 1935 authorizes the Secretary of the Interior to designate areas as national natural landmarks for listing on the National Registry of Natural Landmarks (16 USC 461 et seq.). In conducting an environmental review of a proposed Federal agency action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 35 Code of Federal Regulations (CFR) 62.6(d) to avoid undesirable impacts upon such landmarks.

Under Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) and Executive Order 11593, if a Federal agency undertaking affects any property with historic, architectural, archaeological, or cultural value that is listed on or eligible for listing on the National Register of Historic Places, the responsible official shall comply with the procedures for consultation and comment promulgated by the Advisory Council on Historic Preservation in 36 CFR Part 800. The responsible official must identify properties affected by the undertaking that are potentially eligible for listing on the National Register and may request a determination of eligibility from the Keeper of the National Register, Department of the Interior, under the procedures in 36 CFR Part 63.

Under the National Historic Preservation Act, if a Federal agency activity may cause loss or destruction of significant scientific, prehistoric, historic, or archaeological property, the responsible official or the Secretary of the Interior is authorized to undertake data recovery and preservation activities. Data recovery and preservation activities shall be conducted in accordance with implementing procedures promulgated by the Secretary of the Interior.

The American Indian Religious Freedom Act of 1978 (PL 95-341; 92 STAT 469; 42 USC 1996) states that it is the policy of the United States to protect and preserve for Native Americans their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, including access to sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites.

The Archaeological Resources Protection Act of 1979 (PL 96-95; 93 STAT 722; 16 USC 470aa-47011) provides guidelines for dealing with archaeological resources on public and American Indian land. It details the permit procedures necessary for excavation and outlines the criminal and civil penalties for the illegal removal of archaeological materials from Federal land.

The Native American Graves Protection and Repatriation Act (1990) (PL 101-601; 25 USC 3001 et seq.) requires any person who wishes to excavate Native American remains and grave goods on Federal land to obtain a permit and to give the Indian tribe most closely associated with those goods the opportunity to reclaim them. The act also addresses the incidental discovery of such items on Federal land by persons engaged in other activities, such as mining or construction. When one or more of these items are found, the activity must cease and a reasonable effort made to protect the items. Written notification must be made to the Federal land manager in charge and to the appropriate tribe or organization, who are allowed 30 days in which to make a determination as to the appropriate disposition for these remains.

General

NEPA (42 USC 4321 et seq.) is the basic U.S. charter for protection of the environment. It establishes policy, sets goals, and provides means for carrying out the policy. The NEPA contains "action-forcing" provisions to make sure that Federal agencies act according to the letter and the spirit of the act. NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing the NEPA. The NEPA process is intended to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment.

The Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the NEPA (40 CFR 1500-15080) are issued pursuant to NEPA; the Environmental Quality Improvement Act of 1970, as amended (42 USC 4371 et seq.); section 309 of the Clean Air Act, as amended (42 USC 7609); and Executive Order 11514, Protection and Enhancement of Environmental Quality (as amended by Executive Order

11991). The purpose of the regulations is to provide direction to Federal agencies so they understand how to comply with the procedures and achieve the goals of the NEPA process.

Hazardous Materials and Waste

Under the Resource Conservation and Recovery Act (RCRA), Congress declares the national policy of the United States to be, whenever feasible, the reduction or elimination, as expeditiously as possible, of hazardous waste (42 USC 6901 et seq.). Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment.

RCRA defines solid waste as any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities. To regulate solid waste, RCRA provides for the development of state plans for waste disposal and resource recovery. RCRA encourages and affords assistance for solid waste disposal methods that are environmentally sound, maximize the utilization of valuable resources, and encourage resource conservation. RCRA also regulates mixed low-level radioactive wastes. A mixed waste contains both a hazardous waste and radioactive waste.

RCRA defines waste as hazardous through four characteristics: ignitability, corrosivity, reactivity, or toxicity. Listed wastes are also classified as hazardous. Once defined as a hazardous waste, the RCRA establishes a comprehensive cradle-to-grave program to regulate hazardous waste from generation through proper disposal or destruction.

RCRA also establishes a specific permit program for the treatment, storage, and disposal of hazardous waste. Both interim status and final status permit programs exist.

Any underground tank containing hazardous waste is also subject to RCRA regulation. Under the act, an underground tank is one with 10 percent or more of its volume underground. Underground tank regulations include design, construction, installation, and release-detection standards.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)—commonly known as Superfund—provides for funding, cleanup, enforcement authority, and emergency response procedures for releases of hazardous substances into the environment (42 USC 9601 et seq.).

CERCLA covers the cleanup of toxic releases at uncontrolled or abandoned hazardous waste sites. By comparison, the principal objective of RCRA is to regulate active hazardous waste storage, treatment, and disposal sites to avoid new Superfund sites. RCRA seeks to prevent hazardous releases; a release triggers CERCLA.

The goal of the CERCLA-mandated program (Superfund) is to clean up abandoned and inactive waste sites where releases have occurred or where hazardous substances threaten release into the environment. A trust fund supported, in part, by a tax on petroleum and chemicals supports the Superfund. The Superfund allows the Government to take action now and seek reimbursement later.

CERCLA also mandates spill-reporting requirements. The act requires immediate reporting of a release of a hazardous substance (other than a Federally permitted release) if the release is greater than or equal to the reportable quantity for that substance.

Title III of the Superfund Amendments and Reauthorization Act (SARA) (42 USC 9601 et seq.) is a freestanding legislative program known as the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The act requires immediate notice for accidental releases of hazardous substances and extremely hazardous substances; provision of information to local emergency planning committees for the development of emergency plans; and availability of material safety data sheets, emergency and hazardous chemical inventory forms, and toxic release forms. (EPCRA of 1986, 42 USC 11001 et seq.)

EPCRA requires each state to designate a state emergency response commission. In turn, the state must designate emergency planning districts and local emergency planning commissions (42 USC 11001 et seq.). The primary responsibility for emergency planning is at the local level.

The Pollution Prevention Act of 1990 established that pollution should be prevented at the source, recycled or treated in an environmentally safe manner, and disposed of or otherwise released only as last resort. Executive Order 12856, "Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements," commits Federal agency planning, management, and acquisition to the Pollution Prevention Act of 1990. It also requires all Federal facilities to comply with EPCRA to develop a written pollution prevention strategy emphasizing source reduction, and to develop voluntary goals to reduce total releases and off-site transfers of Toxic Release Inventory toxic chemicals by 50 percent by 1999.

The Toxic Substances Control Act (TSCA) authorizes the administrator of the EPA broad authority to regulate chemical substances and mixtures which may present an unreasonable risk of injury to human health or the environment (15 USC 2601 et seq.).

Under TSCA, the EPA may regulate a chemical when the administrator finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture poses or will pose an unreasonable risk of injury to health or the environment.

Under TSCA, the EPA administrator, upon a finding of unreasonable risk, has a number of regulatory options or controls. The EPA's authority includes total or partial bans on production, content restrictions, operational constraints, product warning statements,

instructions, disposal limits, public notice requirements, and monitoring and testing obligations.

The TSCA Chemical Substance Inventory is a database providing support for assessing human health and environmental risks posed by chemical substances. As such, the inventory is not a list of toxic chemicals. Toxicity is not a criterion used in determining the eligibility of a chemical substance for inclusion on the inventory.

The Transportation Safety Act of 1974, subtitled the Hazardous Materials Transportation Act (HMTA) (49 USC 1801-1819), centralized in the Department of Transportation the authority to promulgate and enforce hazardous materials regulations for all modes of transportation. These regulations may govern any safety aspect of transporting hazardous materials, including the packing, repacking, handling, labeling, marking, placarding, and routing (other than with respect to pipelines).

Other areas subject to regulation by the Department of Transportation are the manufacturing, fabricating, marking, maintenance, reconditioning, repairing, and testing of any package or container which is certified or sold for use in transporting hazardous materials. The registration of applicable personnel involved with these operations may also be required and regulated.

HMTA authorized the establishment of criteria for the handling of hazardous materials. This criteria may include the designation of a minimum number of personnel to be involved in hazardous materials shipments, the establishment of minimum qualifications and training levels for such personnel, requirements for inspections, specifications for equipment to be used for the detection of hazardous materials, and the establishment of a system of monitoring safety assurance procedures for the transportation of hazardous materials.

Hazardous waste management at Redstone Arsenal is regulated under 40 CFR 260-280 and Alabama Administrative Code 22-30, Hazardous Waste Management. These regulations are implemented through MICOM Regulation 200-2, Chapter 5, Hazardous and Solid Waste Management. Storage, treatment and disposal hazardous waste operations are conducted in accordance with RCRA Part B permit (AL7-210-020-742). The DEMP's HMWMS Operating Guidelines define specific procedures for analyzing and turning in hazardous wastes. (Redstone Arsenal, 1997, Hazardous Material/Waste Management System Operating Guidelines) Biennial reports of all hazardous waste material generated by the Army and Thiokol are sent to ADEM.

Health and Safety

The U.S. Occupational Safety and Health Administration (OSHA) is responsible for regulations protecting worker health and safety. The OSHA regulations can be found in Title 29 of the CFR.

Each Federal agency has the responsibility to establish and maintain an effective and comprehensive occupational safety and health program that is consistent with national standards. Each agency must:

- Provide safe and healthful conditions and places of employment
- Acquire, maintain, and require use of safety equipment
- Keep records of occupational accidents and illnesses
- Report annually to the Secretary of Labor

Finally, the SARA (42 USC 9601 et seq.) requires the Occupational Safety and Health Administration to issue regulations specifically designed to protect workers engaged in hazardous waste operations. The hazardous waste rules include requirements for hazard communication, medical surveillance, health and safety programs, air monitoring, decontamination, and training. For all Army operations, Army Regulation (AR) 385-10, *Army Safety Program*, establishes the basis for worker safety programs.

Protection of public health and safety is the responsibility of the EPA (mandated through a variety of laws—the RCRA, CERCLA/SARA, and CAA). EPA regulations can be found in 40 CFR. Additional safety responsibilities are placed on the Department of Transportation for transportation issues (49 CFR), Department of Defense (DOD Directives, applicable to military operations only), and Department of the Army (program requirements established in AR 385-10). Protection of flora and fauna is described under biological resources.

49 CFR requirements pertaining to the safe shipping and transport handling of hazardous materials (which can include hazardous chemical materials, radioactive materials, and explosives) are found in the USDOT Hazardous Materials Regulations and Motor Carrier Safety Regulations codified in 49 CFR Parts 107, 171-180 and 390-397). These regulations specify all requirements that must be observed for shipment of hazardous materials over highways (truck shipment) or by air. Requirements include specific packaging requirements, material compatibility issues, requirements for permissible vehicle/shipment types, vehicle marking requirements, driver training and certification requirements, and notification requirements (as applicable).

Executive Order 12898 directs Federal actions to address environmental justice in minority and low-income populations. Each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that they do not exclude persons from participation or benefit. Persons will also not be discriminated under such programs, policies, or activities because of their race, color, or national origin.

Noise

The Federal Noise Control Act directs all Federal agencies to the fullest extent within their authority to carry out programs within their control in a manner that furthers the promotion of an environment free from noise that jeopardizes the health or welfare of any American (42 USC 4901 et seq.). The act requires a Federal department or agency engaged in any

activity resulting in the emission of noise to comply with Federal, state, interstate, and local requirements respecting control and abatement of environmental noise.

Water Quality

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 USC 1251 et seq.).

The Clean Water Act prohibits any discharge of pollutants into any public waterway unless authorized by a permit (33 USC 1251 et seq.). Under the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit establishes precisely defined requirements for water pollution control.

NPDES permit requirements typically include effluent limitations (numerical limits on the quantity of specific pollutants allowed in the discharge); compliance schedules (abatement program completion dates); self-monitoring and reporting requirements; and miscellaneous provisions governing modifications, emergencies, etc.

Under the Clean Water Act the EPA is the principal permitting and enforcement agency for NPDES permits. This authority may be delegated to the states.

The Clean Water Act requires all branches of the Federal government involved in an activity that may result in a point-source discharge or runoff of pollution to U.S. waters to comply with applicable Federal, interstate, state, and local requirements.

The Safe Drinking Water Act sets primary drinking water standards for owners or operators of public water systems and seeks to prevent underground injection that can contaminate drinking water sources (42 USC 300f et seq.).

Under the Safe Drinking Water Act, the EPA has adopted National Primary Drinking Water Regulations (40 CFR, Part 141) that define maximum contaminant levels in public water systems. In addition, under the Safe Drinking Water Act the EPA may adopt a regulation that requires the use of a treatment technique in lieu of a maximum contaminant level. The EPA may delegate primary enforcement responsibility for public water systems to a state.

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Appendix B
Consultation Letters



DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P. O. BOX 128
KEKAMA, HAWAII 86752-0128

IN REPLY REFER TO

5090
Ser 7031.5/ 0488
13 JUL 1993

Mr. Robert Smith
United States Fish and Wildlife Service
United States Department of the Interior
300 Ala Moana Boulevard, Room 3108 Box 50088
Honolulu, Hawai'i 96850

Dear Mr. Smith:

An Environmental Assessment (EA) is being prepared in support of the creation of a Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. This EA is in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. In order to complete the process, we are initiating an informal Endangered Species Act Section 7 consultation.

The MSSTIC Facility would be composed of facilities at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base (Enclosure 1). The U.S. Navy requires a land-based capability to test different types of radar technologies and sensors without the expense of flying. The MSSTIC Facility would provide a signal environment consisting of unique targets, clutter, and noise levels representative of operational surveillance and tracking radar for airborne, sea, and land conditions. The sensor unit to be tested at the MSSTIC Facility is the Ultrahigh Frequency Electronically Scanned Array (UESA) unit.

PMRF has supported various test and evaluation programs in the past and environmental documentation exists. An EA was prepared in December 1993, and a Finding of No Significant Impact (FONSI) was published for a previous sensor project, the Mountaintop Sensor Integration and Test Program (MSITP). In addition, a supplemental MSITP EA was completed in 1995 that included a 33-meter (107-foot) tower/antenna structure to support testing of the ADS-18 antenna. The 1993 and 1995 EAs addressed three possible sites: PMRF-Makaha Ridge, PMRF-Kokee, and Kokee Air Force Station (currently Hawaiian Air National Guard Radar Site).

Environmental impacts of recent radar programs at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have also been analyzed in the Advanced Concept Technology Demonstration of the Wide Area Defense Program EA, Army Mountain Top Experiment EA, and the PMRF Enhanced Capability Environmental Impact Statement.

Proposed activities would include installing the MSITP antenna/pedestal structure at PMRF-Kokee; the use of existing facilities at PMRF-Makaha Ridge; and the construction of new support facilities on southern PMRF Main Base.

Proposed activities at PMRF-Kokee would include bringing in support trailers; reinstalling the tower evaluated for the MSITP program; setting up the antenna/pad; installing the MSSTIC hardware on the tower; and evaluating the system.

Personnel would be involved in the development and integration of hardware and software systems at the Kokee facility. The main emphasis at this facility would be the modification of the existing radar system to accommodate the UESA. The existing facility would be upgraded to include a tower capable of supporting the UESA antenna. Radio frequency (RF) transmission (at UHF) would occur at this facility in addition to testing of high power equipment utilizing RF dummy loads. The types of equipment that would be utilized at the PMRF facility are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; cranes and other heavy equipment (during the tower erection and antenna installation phase); and computers/workstations. Only normal cleaning solutions (such as alcohol) and cooling fluids (such as ethylene glycol) would be required.

An instrumentation facility would be established inside the existing buildings at the PMRF-Kokee site, and the original tower would be reinstalled with a low profile antenna radome similar to the ADS-18 configuration (for a total height of less than the original 33 meters [107 feet] analyzed in the previous EA). In addition, a small, 0.61 meter by 1.22 meter (2-foot by 4-foot), antenna would be mounted on the west side of the tower.

At the PMRF-Kokee site, the UESA antenna would be mounted on a gray, galvanized steel tower, to be re-erected as part of the site preparation. The overall height of the antenna structure would provide a clear line-of-sight over existing vegetation. At PMRF-Kokee the radar will only be illuminated in a 205° arc from 145° clockwise to 350° True centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Additionally, nighttime access (2000 to 0600 hours local) to the full 360° around PMRF-Kokee excluding a 15° sector centered around the NASA site on Kokee parcel E is proposed under this EA.

Activities proposed for PMRF-Makaha Ridge would involve installing MSSTIC hardware on existing towers and evaluating the system. The hardware would be set up between PMRF-Kokee and PMRF-Makaha Ridge multiple times over a currently envisioned 5-year period depending on the program test to be supported, if

only one sensor is available. This hardware move could occur several times during the testing period and is currently envisioned to be about once every two years. Depending on the results of testing over this period, the program could go on for longer than five years.

Support equipment for the radar system, located inside the PMRF-Kokee Parcel A building, would be moved to the existing PMRF-Makaha Ridge shelter facilities when required. In addition, the PMRF-Makaha Ridge site has an existing antenna/pedestal unit that would be utilized for the ADS-18S effort. The antenna would be mounted on the existing tower for the duration of the testing period, after which the site will be returned to its original pre-test condition. One shelter at the PMRF-Makaha Ridge site would house the transmitter, the receiver, and the signal processing equipment. A second shelter would house the display and operations center, and a third shelter would house a limited maintenance facility for the site personnel. Each shelter is located on an existing concrete footing, weighs approximately 11,340 kilograms (25,000 pounds), and can be transported by tractor.

The PMRF-Makaha Ridge site would be utilized as is. There are no additional requirements for infrastructure improvements at this site for the support of this project. The original tower and the IDPCA tower located at this site would support program requirements.

At the PMRF-Makaha Ridge site, the program requires 24-hour access to a sector from 145° clockwise to 350° True centered on the PMRF-Makaha Ridge site and extending 370 kilometers (200 nautical miles) west over open ocean.

Activities proposed for PMRF-Main Base would include construction of facility support buildings within an area of 0.4 hectare (1 acre) south of the existing Hawai'i Air National Guard facility in phases. During the first phase of construction, a 279-square meter (3,000-square foot) office/lab building and parking lot would be located within an estimated total area of 1,579 square meters (17,000 square feet). The need for up to two additional facilities is being evaluated. These additional facilities would have an estimated total area of about 560 square meters (6,025 square feet) and would be placed within the 0.4 hectare (1 acre) footprint on PMRF Main Base.

Personnel would be involved in the development and integration of hardware and software systems at the new PMRF-Main Base facility. The development efforts will involve the small scale breadboarding of electronic circuit subassemblies, testing and troubleshooting of electronic subassemblies, and programming at the workstation level. The types of equipment that will be

utilized at the PMRF facility are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; and computers/workstations. The use of hazardous chemicals (outside of the normal cleaning solutions such as alcohol) would not be required. In addition, no high power RF radiation transmission will occur at this facility. Any testing of high power equipment will be performed utilizing RF dummy loads.

All vegetation within PMRF-Kokee and PMRF-Makaha Ridge is ruderal or horticultural landscaping. The proposed new construction on PMRF-Main Base would take place in a portion of a previously disturbed area. No threatened or endangered plant species would be affected by the proposed action. Any outdoor lighting associated with construction activities and permanent structures will be properly shielded, following USFWS guidelines, to avoid attraction of Newell's Shearwaters or other sensitive bird species that may traverse the areas under consideration. The continuation of ongoing and introduction of additional activities at PMRF-Makaha Ridge is not expected to adversely affect the small population of Nene at the site.

There have been no reports of birds being affected by Electromagnetic Radiation (EMR) from the existing sensors located in the PMRF-Kokee or PMRF-Makaha Ridge complexes. In terms of the potential for cumulative EMR exposure effects, it is important to note that no Federal standard has yet been promulgated for exposure to electromagnetic fields, let alone wildlife. No negative impacts are anticipated to native birds as the result of radar beams because the power density of the radar unit will be below the threshold to cause harm to birdlife and the radar will only be illuminated in an 205° arc from 145° clockwise to 350° true centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). The radar unit transmitter will transmit in the frequency ranges of 406 to 450 MHz. Birds also are not expected to remain in the radar beam long enough to be adversely affected by EMR. Human activity may temporarily disturb non-listed terrestrial species, but this disturbance is expected to be temporary.

Impacts on biological resources associated with any incremental increase in the use of radars and other communication instrumentation would be negligible.

Much of the program and testing information provided above was discussed in a meeting with Mr. Michael Molina of your staff on May 17, 1999. At that time, Mr. Molina expressed three issues that he suggested be addressed in the EA. These were (1) researching and discussing the effects of electromagnetic radiation on nesting birds and chick; (2) surveying any areas

planned for ground disturbing activities for listed plant species; and (3) discussing the potential for disorientation of some bird species by lights on the antenna tower. A copy of a working draft EA was shown to him at that time. He also suggested that a copy of that working draft be provided to the Fish and Wildlife Service for information. A copy is enclosed for your use (Enclosure 2).

In order to complete the EA process and as part of an informal Endangered Species Act Section 7 consultation, we are enclosing a table of threatened and endangered species (Enclosure 3) derived from information provided by your office for previous EAs. We would appreciate your concurrence with this list and the discussion provided above, but if you desire additional species to be addressed, please let us know as soon as possible.

If you have any questions, please contact Mr. Averiet Soto at (808) 375-4775.

Sincerely,



M. B. HARRISON
Lieutenant, CEC, U. S. Navy
Public Works Officer
By direction of the
Commanding Officer

Encls:

- (1) Location of Pacific Missile Range Facility and Related Sites on Kauai
- (2) Working Draft Environmental Assessment Mountaintop Surveillance Sensor Test Integration Center Facility, Kauai, Hawaii
- (3) Threatened and Endangered Species Potentially Affected by the MSSTIC Facility

Prepared by:

R. Inouye/031.5/jmt
X-4632/12 Jul 99
USFWSLET.DOC



United States Department of the Interior

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031 *145*

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion

300 Ala Moana Boulevard, Room 3-122

Box 58088, F. P. C. P. C. W. P. P.

Honolulu, Hawaii 96850

AUG 25 1999

In Reply Refer To: LLLW

99 AUG 26 P2:44

Lieutenant M.B. Harrison
Public Works Office
Pacific Missile Range Facility
Department of the Navy
P.O. Box 128
Kekaha, Hawaii 96752-0128

Re: Consultation under Section 7 of the Endangered Species Act for the Mountaintop Surveillance Sensor Test Integration Center Facility, Pacific Missile Range Facility, Kauai, Hawaii. Project #5090 Ser 7031.5/0488

Dear Lieutenant Harrison:

This responds to your July 13, 1999, letter with which you transmitted a working draft of the Environmental Assessment (EA) for the Mountaintop Surveillance Sensor Test Integration Center Facility, Kauai, Hawaii, along with a draft list of Federally protected species that may be found at the project sites (Enclosure 3). You requested that we verify the accuracy of your species list and concur with your determination that the proposed project is not likely to adversely affect these endangered and threatened species, in accordance with section 7 of the U.S. Endangered Species Act of 1973, as amended (Act).

The U.S. Fish and Wildlife Service (Service) has reviewed the information provided by you and pertinent information in our files, including maps prepared by The Nature Conservancy's Hawaii Natural Heritage Program and information compiled by the Service's Hawaii and Pacific Plant Recovery Coordinating Committee. Based on our review, the species list you prepared for the working draft of the EA is accurate. Specifically, the following endangered and threatened species are likely to occur at the project sites: the endangered plants *Sesbania tomentosa* (Ohia) and *Panicum niihauense* (Lau chu); the endangered Hawaiian coot (*Fulica americana alai*), Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian gallinule (*Gallinula chloropus sandvicensis*), Hawaiian duck (*Anas wyvilliana*), Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*), Hawaiian goose (=nene) (*Nesochen sandvicensis*), and Hawaiian hoary bat (*Lasiurus cinereus semotus*); and the threatened Newell's shearwater (*Puffinus auricularis newelli*).

Based on information provided in the working draft of the EA and upon the Navy's assurance, none of the listed plants occur in the areas of planned ground disturbance. In addition, the Navy has agreed to adopt recommended light shielding and seasonal lighting restrictions to substantially reduce the likelihood that listed seabirds would accidentally collide with facility

structures. Although the listed waterbirds are known to use ponds and drainage ditches in the area, these habitats will not be affected by the proposed projects.

Although there are no known effects to birds from electromagnetic radar at this time, the Service requests that the Navy inform us of any downed birds in the area of the towers as this may indicate a problem.

In view of this, the Service concurs that the Navy's action is not likely to adversely affect federally listed species. Based on this determination, we believe that the requirements of section 7 of the Act have been satisfied. However, the Navy's obligations under section 7 of the Act must be reconsidered if (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered, (2) this action is subsequently modified in a manner that was not considered in this assessment, or (3) a new species is listed or critical habitat determined that may be affected by the identified action.

— The Service appreciates the U.S. Navy's concern for threatened and endangered species. If you have any questions, please contact Fish and Wildlife Biologist Lorena Wada (phone: 808/541-3441; fax: 808/541-3470).

Sincerely,



Robert P. Smith
Pacific Islands Manager



DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAMA, HAWAII 96752-0128

IN REPLY REFER TO

5090

Ser 7031.5/ 0557

27 JUL 1999

Mr. Eugene Nitte
National Marine Fisheries Service
Pacific Islands Area Office
1601 Kapiolani Blvd., Suite 1110
Honolulu, HI 96814-4700

Dear Mr. Nitte:

An Environmental Assessment (EA) is being prepared in support of the creation of a Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. This EA is in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. In order to complete the process, we are initiating an informal Endangered Species Act Section 7 consultation.

The MSSTIC Facility would be composed of facilities at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base (Enclosure 1). The U.S. Navy requires a land-based capability to test different types of radar technologies and sensors without the expense of flying. The MSSTIC Facility would provide a signal environment consisting of unique targets, clutter, and noise levels representative of operational surveillance and tracking radar for airborne, sea, and land conditions. The sensor unit to be tested at the MSSTIC Facility is the Ultrahigh Frequency Electronically Scanned Array (UESA) unit.

PMRF has supported various test and evaluation programs in the past and environmental documentation exists. An EA was prepared in December 1993, and a Finding of No Significant Impact (FONSI) was published for a previous sensor project, the Mountaintop Sensor Integration and Test Program (MSITP). In addition, a supplemental MSITP EA was completed in 1995 that included a 33-meter (107-foot) tower/antenna structure to support testing of the ADS-18 antenna. The 1993 and 1995 EAs addressed three possible sites: PMRF-Makaha Ridge, PMRF-Kokee, and Kokee Air Force Station (currently Hawaiian Air National Guard Radar Site).

Environmental impacts of recent radar programs at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have also been analyzed in the Advanced Concept Technology Demonstration of the Wide Area Defense Program EA, Army Mountain Top Experiment EA, and the PMRF Enhanced Capability Environmental Impact Statement.

27 JUL 1989

Proposed activities would include installing the MSITP antenna/pedestal structure at PMRF-Kokee; the use of existing facilities at PMRF-Makaha Ridge; and the construction of new support facilities on southern PMRF Main Base.

Proposed activities at PMRF-Kokee would include bringing in support trailers; reinstalling the tower evaluated for the MSITP program; setting up the antenna/pad; installing the MSSTIC hardware on the tower; and evaluating the system.

Personnel would be involved in the development and integration of hardware and software systems at the Kokee facility. The main emphasis at this facility would be the modification of the existing radar system to accommodate the UESA. The existing facility would be upgraded to include a tower capable of supporting the UESA antenna. Radio frequency (RF) transmission (at UHF) would occur at this facility in addition to testing of high power equipment utilizing RF dummy loads. The types of equipment that would be utilized at the PMRF facility are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; cranes and other heavy equipment (during the tower erection and antenna installation phase); and computers/workstations. Only normal cleaning solutions (such as alcohol) and cooling fluids (such as ethylene glycol) would be required.

An instrumentation facility would be established inside the existing buildings at the PMRF-Kokee site, and the original tower would be reinstalled with a low profile antenna radome similar to the ADS-18 configuration (for a total height of less than the original 33 meters [107 feet] analyzed in the previous EA). In addition, a small, 0.61 meter by 1.22 meter (2-foot by 4-foot), antenna would be mounted on the west side of the tower.

At the PMRF-Kokee site, the UESA antenna would be mounted on a gray, galvanized steel tower, to be re-erected as part of the site preparation. The overall height of the antenna structure would provide a clear line-of-sight over existing vegetation. At PMRF-Kokee the radar will only be illuminated in a 205° arc from 145° clockwise to 350° True centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Additionally, nighttime access (2000 to 0600 hours local) to the full 360° around PMRF-Kokee excluding a 15° sector centered around the NASA site on Kokee parcel E is proposed under this EA.

Activities proposed for PMRF-Makaha Ridge would involve installing MSSTIC hardware on existing towers and evaluating the system. The hardware would be set up between PMRF-Kokee and PMRF-Makaha Ridge multiple times over a currently envisioned 5-year period depending on the program test to be supported, if

5090
Ser 7031.5/ 0557
27 JUL 89

only one sensor is available. This hardware move could occur several times during the testing period and is currently envisioned to be about once every two years. Depending on the results of testing over this period, the program could go on for longer than five years.

Support equipment for the radar system, located inside the PMRF-Kokee Parcel A building, would be moved to the existing PMRF-Makaha Ridge shelter facilities when required. In addition, the PMRF-Makaha Ridge site has an existing antenna/pedestal unit that would be utilized for the ADS-18S effort. The antenna would be mounted on the existing tower for the duration of the testing period, after which the site will be returned to its original pre-test condition. One shelter at the PMRF-Makaha Ridge site would house the transmitter, the receiver, and the signal processing equipment. A second shelter would house the display and operations center, and a third shelter would house a limited maintenance facility for the site personnel. Each shelter is located on an existing concrete footing, weighs approximately 11,340 kilograms (25,000 pounds), and can be transported by tractor.

The PMRF-Makaha Ridge site would be utilized as is. There are no additional requirements for infrastructure improvements at this site for the support of this project. The original tower and the IDPCA tower located at this site would support program requirements.

At the PMRF-Makaha Ridge site, the program requires 24-hour access to a sector from 145° clockwise to 350° True centered on the PMRF-Makaha Ridge site and extending 370 kilometers (200 nautical miles) west over open ocean.

Activities proposed for PMRF-Main Base would include construction of facility support buildings within an area of 0.4 hectare (1 acre) south of the existing Hawai'i Air National Guard facility in phases. During the first phase of construction, a 279-square meter (3,000-square foot) office/lab building and parking lot would be located within an estimated total area of 1,579 square meters (17,000 square feet). The need for up to two additional facilities is being evaluated. These additional facilities would have an estimated total area of about 560 square meters (6,025 square feet) and would be placed within the 0.4 hectare (1 acre) footprint on PMRF Main Base.

Personnel would be involved in the development and integration of hardware and software systems at the new PMRF-Main Base facility. The development efforts will involve the small scale breadboarding of electronic circuit subassemblies, testing and troubleshooting of electronic subassemblies, and programming at the workstation level. The types of equipment that will be

5090
Ser 7031.5/ 0557
27 JUL 1999

utilized at the PMRF facility are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; and computers/workstations. The use of hazardous chemicals (outside of the normal cleaning solutions such as alcohol) would not be required. In addition, no high power RF radiation transmission will occur at this facility. Any testing of high power equipment will be performed utilizing RF dummy loads.

All vegetation within PMRF-Kokee and PMRF-Makaha Ridge is ruderal or horticultural landscaping. The proposed new construction on PMRF-Main Base would take place in a portion of a previously disturbed area. No threatened or endangered plant species would be affected by the proposed action. Any outdoor lighting associated with construction activities and permanent structures will be properly shielded, following USFWS guidelines, to avoid attraction of Newell's Shearwaters or other sensitive bird species that may traverse the areas under consideration. The continuation of ongoing and introduction of additional activities at PMRF-Makaha Ridge is not expected to adversely affect the small population of Nene at the site.

There have been no reports of birds being affected by Electromagnetic Radiation (EMR) from the existing sensors located in the PMRF-Kokee or PMRF-Makaha Ridge complexes. In terms of the potential for cumulative EMR exposure effects, it is important to note that no Federal standard has yet been promulgated for exposure to electromagnetic fields, let alone wildlife. No negative impacts are anticipated to native birds as the result of radar beams because the power density of the radar unit will be below the threshold to cause harm to birdlife and the radar will only be illuminated in an 205° arc from 145° clockwise to 350° true centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). The radar unit transmitter will transmit in the frequency ranges of 406 to 450 MHz. Birds also are not expected to remain in the radar beam long enough to be adversely affected by EMR. Human activity may temporarily disturb non-listed terrestrial species, but this disturbance is expected to be temporary.

Impacts on biological resources associated with any incremental increase in the use of radars and other communication instrumentation would be negligible.

Much of the program and testing information provided above was discussed in a meeting with Mr. Michael Molina of your staff on May 17, 1999. At that time, Mr. Molina expressed three issues that he suggested be addressed in the EA. These were (1) researching and discussing the effects of electromagnetic radiation on nesting birds and chick; (2) surveying any areas

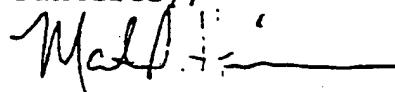
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Ser 7031.5/ 0 5 57
27 JUL 1989

planned for ground disturbing activities for listed plant species; and (3) discussing the potential for disorientation of some bird species by lights on the antenna tower. A copy of a working draft EA was shown to him at that time. He also suggested that a copy of that working draft be provided to the Fish and Wildlife Service for information. A copy is enclosed for your use (Enclosure 2).

In order to complete the EA process and as part of an informal Endangered Species Act Section 7 consultation, we are enclosing a table of threatened and endangered species (Enclosure 3) derived from information provided by your office for previous EAs. We would appreciate your concurrence with this list and the discussion provided above, but if you desire additional species to be addressed, please let us know as soon as possible.

If you have any questions, please contact Mr. Averiet Soto at (808) 335-4775 or Mr. David Anderson at (808) 335-4823.

Sincerely,



M. B. HARRISON
Lieutenant, CEC, U. S. Navy
Public Works Officer
By direction of the
Commanding Officer

Encls:

- (1) Location of Pacific Missile Range Facility and Related Sites on Kauai
- (2) Working Draft Environmental Assessment Mountaintop Surveillance Sensor Test Integration Center Facility, Kauai, Hawaii
- (3) Threatened and Endangered Species Potentially Affected by the MSSTIC Facility
- (4) Electromagnetic Radiation Hazards and Electromagnetic Compatibility Study



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Pacific Islands Area Office
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814-0047

M. B. Harrison
Lieutenant, CEC, U. S. Navy
Public Works Officer
Pacific Missile Range Facility
P. O. Box 128
Kekaha, Hawaii 96752-0128

SEP 13 1999

Dear Lt. Harrison:

Thank you for your request to initiate Section 7 consultation regarding the proposed construction of the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility (PMRF), Kauai, Hawaii. The proposed activity includes the installation and operation of the MSSTIC antenna/pedestal structure at PMRF - Kokee, the use of existing facilities at PMRF - Makaha Ridge; and the construction of new support facilities on the southern portion of the PMRF Main Base. Although threatened green turtles (*Chelonia mydas*) are found offshore from some of the project sites, they are not likely to be affected based on the locations of the construction and operation activities. Accordingly, I find that the proposed project will not likely adversely affect green turtles, or other listed species or designated critical habitat under the jurisdiction of the National Marine Fisheries Service.

This concludes the informal Section 7 consultation process for the proposed MSSTIC. Consultation must be reinitiated if new information becomes available revealing effects of the project on listed species that were not previously considered, the project is subsequently modified in a manner that causes an effect to listed species that was not considered, or if a new species or critical habitat is designated that may be affected by this action.

Please contact Ms. Margaret M. Dupree at 808/973-2935 ext. 210 should you have any further questions concerning this Section 7 consultation.

Sincerely,

C. Kainale
Rodney McInnis
Acting Regional Administrator

cc: F/SWR - Stevens
F/SWRx1 - Dupree
USFWS - K. Rosa





DEPARTMENT OF THE NAVY

PACIFIC MISSILE RANGE FACILITY
P O BOX 128
KEXAMA, HAWAII 96752-0128

IN REPLY REFER TO:

5090

Ser 7031.5A/ 0798
13 OCT 1998

Mr. Timothy E. Johns
State Historic Preservation Office
Hawai'i Department of Land and Natural Resources
1151 Punchbowl Street, Room 130
Honolulu, Hawai'i 96813

Dear Mr. Johns:

An Environmental Assessment (EA) is being prepared in support of the creation of the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility (PMRF), Kauai, Hawai'i. Enclosed, for your use, is a description of the proposed actions associated with the MSSTIC Facility at PMRF. This EA is in compliance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations implementing NEPA. In order to complete the process, we are initiating a Section 106 consultation and review for this undertaking and for actions related to cultural and historic resources aspects of a MSSTIC Facility at PMRF.

Information on cultural resources was obtained from previous environmental documentation conducted at PMRF and its ancillary facilities. Section 106 determinations of no effect were made for similar projects since no historic sites were identified within the parameters of the project areas at PMRF-Koke'e and PMRF-Makaha Ridge. Based upon your previous concurrence with the Navy's no effect determination for the Mountaintop Sensor Integration and Test Program (MSITP) and PMRF Enhancement programs, we believe that the MSSTIC Facility activities will have no effect on the island's historic and cultural resources. In accordance with 36 CFR Part 800.5, we are seeking your concurrence with our determination.

As part of our preliminary consultation, staff at PMRF met with your designated representative, Ms. Nancy McMahon, on May 19, 1999, to discuss this project. Thank you for your August 5, 1999, response (Log No: 23511, Doc No: 9905NM11) to that preliminary consultation on the MSSTIC Facility. In that response you identified two concerns: (1) that consultation with Native Hawaiian organizations, under the requirements of the Native American Graves Protection and Repatriation Act would be necessary; and (2) the need for inventory surveying in the area on PMRF Main Base where ground disturbing activities might occur.

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Ser 7031.5A/0798
11 Oct 1998

You also indicated your concurrence with our "no effect" determinations for the activities at PMRF-Koke'e and PMRF-Makaha Ridge.

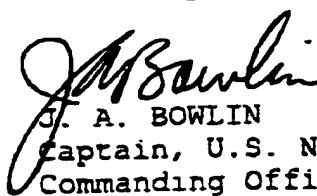
Consultation was performed with the required Native Hawaiian organizations stated under the law as part of the recent PMRF Enhanced Capability Environmental Impact Statement (EIS) that addressed standard base operations activities. A Programmatic Agreement was signed as part of the EIS process. We believe the base operational activities associated with the MSSTIC Facility are included in this agreement and therefore plan no further consultations with Native Hawaiian organizations on this issue.

Prior to any ground disturbing activities on the 0.4-hectare (1-acre) site within an area of 1.2 hectares (3 acres) south of the existing Hawai'i Air National Guard Headquarters, diagonal trenching will be undertaken to ensure no significant resources are affected. In addition, per your staff's request (Nancy McMahon), archeological monitors will be available to inspect the areas being disturbed. These measures have been incorporated into the EA. The results of the survey will be handled in accordance with the Programmatic Agreement.

Should cultural resources be discovered as a result of the activities proposed, they will be investigated and evaluated in accordance with the National Register of Historic Places eligibility criteria. All appropriate measures would be taken to mitigate impacts to properties considered eligible. Avoidance of cultural resources by relocating the potential facility siting area would be the primary mitigation measure.

If you have any questions, please contact Mr. Averiet Soto at (808) 335-4775 or Mr. David Anderson (808) 335-4823.

Sincerely,


J. A. BOWLIN
Captain, U.S. Navy
Commanding Officer

Enclosure

(1) Description of Proposed
Actions - MSSTIC Facility

5090
Ser 7031.5A/0798
13 OCT 1998

Copy to:
Mr. Don J. Hibbard
State Historic Preservation Division
P.O. Box 621
Honolulu, Hawai'i 96809

Ms. Nancy McMahon
State Historic Preservation Division
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawai'i 96707

DESCRIPTION OF PROPOSED ACTIONS - MSSTIC FACILITY

PMRF, KAUAI, HAWAII SEPTEMBER 1999

The MSSTIC Facility would be composed of facilities at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base. The U.S. Navy requires a land-based capability to test different types of radar technologies and sensors without the expense of flying. The MSSTIC Facility would provide a signal environment consisting of unique targets, clutter, and noise levels representative of operational surveillance and tracking radar for airborne, sea, and land conditions. The sensor to be tested at the MSSTIC Facility is the Ultrahigh Frequency Electronically Scanned Array (UESA) unit.

PMRF has supported various test and evaluation programs in the past and environmental documentation exists. An EA was prepared in December 1993, and a Finding of No Significant Impact (FONSI) was published for a previous sensor project, the Mountaintop Sensor Integration and Test Program (MSITP). In addition, a supplemental MSITP EA was completed in 1995 that included a 33-meter (107-foot) tower/antenna structure to support testing of the ADS-18 antenna. As part of the mitigation measures for that project, the tower was taken down after testing was completed. The 1993 and 1995 EAs addressed three possible sites: PMRF-Makaha Ridge, PMRF-Kokee, and Kokee Air Force Station (currently Hawai'i Air National Guard Radar Site). Environmental impacts of recent radar programs at PMRF-Kokee, PMRF-Makaha Ridge, and PMRF-Main Base have also been analyzed in the Advanced Concept Technology Demonstration of the Wide Area Defense Program EA, Army Mountain Top Experiment EA, and the PMRF Enhanced Capability EIS.

Proposed activities for the MSSTIC project would include reinstalling the MSITP antenna/pedestal structure at PMRF-Kokee; the use of existing facilities at PMRF-Makaha Ridge; and the construction of new support facilities on southern PMRF Main Base.

Proposed activities at PMRF-Kokee would include bringing in support trailers; reinstalling the tower evaluated for the MSITP program; setting up the antenna/pad; installing the MSSTIC hardware on the tower; and evaluating the system.

Personnel would be involved in the development and integration of hardware and software systems at the Kokee facility. The main emphasis at this facility would be the

modification of the existing radar system to accommodate the UESA. The existing facility would be upgraded to include the reinstalled tower capable of supporting the UESA antenna. Radio frequency (RF) transmission (at ultrahigh frequency (UHF)) would occur at this facility in addition to testing of high power equipment utilizing RF dummy loads. The types of equipment that would be utilized are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; cranes and other heavy equipment (during the tower erection and antenna installation phase); and computer workstations. Only normal cleaning solutions (such as alcohol) and cooling fluids (such as ethylene glycol) would be required.

An instrumentation facility would be established inside the existing buildings at the PMRF-Kokee site, and the original tower would be reinstalled with a low profile antenna radome similar to the ADS-18 configuration (for a total height less than the original 33 meters [107 feet] analyzed in the previous EA). In addition, a small 0.61-meter by 1.22-meter (2-foot by 4-foot) antenna would be mounted on the west side of the tower.

At the PMRF-Kokee site, the UESA antenna would be mounted on a gray, galvanized steel tower, to be re-erected as part of the site preparation. The overall height of the antenna structure would provide a clear line-of-sight over existing vegetation. At PMRF-Kokee, the radar would only be illuminated in a 205° arc from 145° clockwise to 350° True, centered at PMRF-Kokee and extending 370 kilometers (200 nautical miles). Additionally, nighttime access (2000 to 0600 hours local) to the full 360° around PMRF-Kokee excluding a 40° sector centered around the National Aeronautics Space Administration (NASA) site on Kokee Parcel C is proposed under this EA.

Activities proposed for PMRF-Makaha Ridge would involve installing MSSTIC hardware on existing towers and evaluating the system. The hardware would be set up between PMRF-Kokee and PMRF-Makaha Ridge multiple times over a currently envisioned 5-year period depending on the program test to be supported, if only one sensor is available. This hardware move could occur several times during the testing period and is currently envisioned to be about once every two years. Depending on the results of testing over this period, the program could go on for a longer period than five years.

Support equipment for the radar system, located inside the PMRF-Kokee parcel A building, would be moved to the existing PMRF-Makaha Ridge shelter facilities when required. In addition, the PMRF-Makaha Ridge site has an existing antenna/pedestal unit that would be utilized for the ADS-18S effort. The antenna would

be mounted on the existing tower for the duration of the testing period, after which the site will be returned to its original condition. One shelter at the PMRF-Makaha Ridge site would house the transmitter, the receiver, and the signal processing equipment. A second shelter would house the display and operations center, and a third shelter would house a limited maintenance facility for the site personnel. Each shelter is located on an existing concrete footing, weighs approximately 11,340 kilograms (25,000 pounds), and can be transported by tractor.

The PMRF-Makaha Ridge site would be utilized as is. There are no additional requirements for infrastructure improvements at this site for support of this project. The original tower and the Inverse Displaced Center Array tower located at this site would support program requirements.

At the PMRF-Makaha Ridge site, the program would require 24-hour access to a sector from 145° clockwise to 350° True, centered at PMRF-Makaha Ridge and extending 370 kilometers (200 nautical miles) west over open ocean.

Activities proposed for PMRF-Main Base would include construction, in phases, of facility support buildings within an area of 0.4 hectare (1 acre) south of the existing Hawai'i Air National Guard facility. During the first phase of construction, a 279-square meter (3,000-square foot) office/lab building and parking lot would be located within an estimated total area of 1,579 square meters (17,000 square feet). The need for up to two additional facilities is being evaluated. These additional facilities would have an estimated total area of approximately 560 square meters (6,025 square feet) and would be placed within the 0.4-hectare (1-acre) footprint on PMRF-Main Base.

Personnel would be involved in the development and integration of hardware and software systems at the new PMRF-Main Base facility. The development efforts will involve the small scale breadboarding of electronic circuit subassemblies, testing and troubleshooting of electronic subassemblies, and programming at the workstation level. The types of equipment that will be utilized at the PMRF facility are test instrumentation (oscilloscopes, digital multimeters, network analyzers, logic analyzers, spectrum analyzers, etc.); small single station soldering equipment; and computers/workstations. The use of hazardous chemicals (outside of the normal cleaning solutions such as alcohol) would not be required. In addition, no high power RF radiation transmission will occur at this facility. Any testing of high power equipment will be performed utilizing RF dummy loads.



PMRF ADMIN

99 AUG -9 PM 2:00 STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
501 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

031.5
031.4

PMRF
August 5, 1999
AUG 10 A 8:56

by Staff

Commanding Officer
Attn: Code 7031.5A (D.R. Anderson)
Department of the Navy
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Hawaii 96752

LOG NO: 23511
DOC NO: 9905NM11

Dear Mr. Anderson:

**SUBJECT: National Historic Preservation Act Review, Section 106 Compliance
-- Preliminary Consultation for PMRF MSSTIC/UESA Project
Mano, Waimea, Kauai**

Thank you for the submission of the a few pages from your Draft EA and for meeting with Nancy McMahon our Kauai Archaeologist at PMRF. In addition to compliance with the National Historic Preservation Act, you will also need to comply with Native American Graves Protection and Repatriation Act. which means consultation with required Native Hawaiian organization stated under the law: Hui Malama, OHA, and the Kauai/Ni'ihiwai Island Burial Council. We would like to know these concerns so that they may be incorporated into our official comments on the project. We also recommend you consult with other concern Native Hawaiian organizations. In regards to compliance with ARPA, once you select your consulting archaeologist, you will be the federal agency granting the ARPA permit to conduct archaeology on federal lands (PMRF).

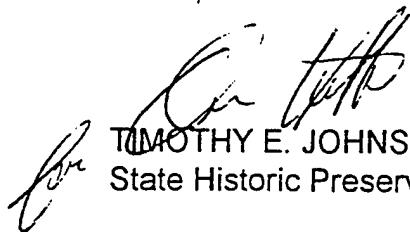
We can concur with your "no effect" determinations for Makaha Ridge and Koke'e area. These areas have already been impacted. We agree with State Parks concerns that it would be best to paint the metal of the tower a natural color, in order to blend into the landscape better. Our concerns mainly lay with the PMRF location for the proposed buildings. No archaeological inventory survey has been conducted in this location. The adjacent HIANG Headquarters had an inventory survey conducted, and then the requirement to have archaeological monitoring as a mitigation for possible burials in the remnant dunes. Once the inventory survey with trenching for subsurface finds is completed we can then better recommend possible mitigation, if necessary.

Anderson

2

If you have any questions, please call Nancy McMahon 742-7033.

Aloha,



TIMOTHY E. JOHNS

State Historic Preservation Officer

NM:amk

c. Advisory Council, Western Region

JAMES J. CAFFREY
GOVERNOR OF HAWAII



TIMOTHY E. JOHNS, CHIEF
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JAMES P. GOMEZ

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kekaha Kai Building, Room 202
501 Kamiloa Boulevard
Kekaha, Hawaii 96752

AQUATIC RESOURCES
BOATING AND OCEAN REGULATIONS
CONSERVATION AND RESOURCES
DEPARTMENT
ENVIRONMENTS
HISTORIC AND CULTURAL
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

November 8, 1999

J. A. Bowlin, Captain
Commanding Officer
Attn: Code 7031 5A (D.R. Anderson)
Department of the Navy
Pacific Missile Range Facility
P O. Box 128
Kekaha, Hawaii 96752

LOG NO: 24377
DOC NO: 9911NMU1

Dear Captain Bowlin,

**SUBJECT: National Historic Preservation Act Review, Section 106 Compliance
EA for MSSTIC/UESA Project, Mana, Waimua, Kauai**

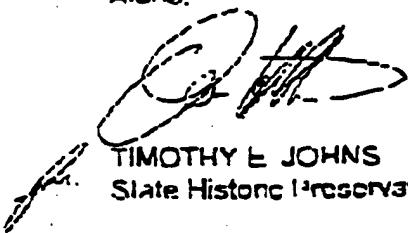
We would with additional information most likely concur with your "no historic properties affected" determinations for Makaha Ridge and Kokee area. Those areas have already been impacted on are on existing facilities.

Our concerns mainly lay with the PMRF location for the proposed buildings. No archaeological inventory has been conducted in this location. So we are uncertain if historic properties exist in the project area. Once the inventory survey with trenching for subsurface finds is completed, your agency and ours can then better evaluate mitigation needs, as necessary.

The adjacent HIANG Headquarters had an inventory survey conducted with the requirement to have archaeological monitoring as a proposed mitigation for possible burials in the remnant dunes.

If you have any questions, please call Nancy McMahon 742-7033

Aloha,


TIMOTHY E. JOHNS
State Historic Preservation Officer

NM.amk

Appendix C
Coastal Zone Management Form

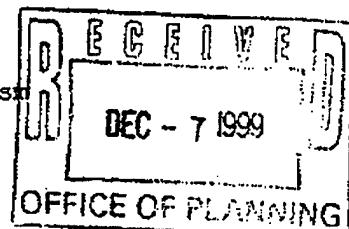


DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAHA, HAWAII 96752-0128

IN REPLY REFER TO:

5090
Ser 7031.5A/ 0906
06 DEC 1999

Mr. David Blane
Director, State of Hawaii Office of Planning
Department of Business, Economic Development and Tourism
P.O. Box 2359
Honolulu, Hawaii 96804



Dear Mr. Blane:

The Department of the Navy has prepared an Environmental Assessment (EA) that analyzes the impacts of creating the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC). Facility to provide a ground-based test capability to evaluate and compare new and updated sensor technologies.

The Proposed Action would occur at three sites: the Pacific Missile Range Facility-(PMRF) Kokee, PMRF-Makaha Ridge, and PMRF-Main Base. All sites are located on the Island of Kauai, Hawaii. The tower originally installed and removed as part of the Mountaintop Sensor Integration and Test program would be reinstalled at PMRF-Kokee. The existing radar antenna/pad would be modified to support testing of sensor systems. Hardware and software systems would be developed and integrated. MSSTIC hardware would be installed and evaluated on existing towers at PMRF-Makaha Ridge. The hardware would be rotated between PMRF-Kokee and PMRF-Makaha Ridge approximately once every two years during the estimated 5-year test period. The sites would be returned to their original condition at the end of the testing period. Tests would involve using targets of opportunity such as aircraft and floating jammers.

Facility support buildings could be constructed on a 0.4 hectare (1-acre) site on the southern part of PMRF-Main Base within a 1.2-hectare (3-acre) area south of the existing Hawaii Air National Guard facility. If the program does not build on base, personnel would occupy existing office space there and possibly in Waimea at the West Kauai Technology and Visitor Center.

Based on a recommendation by Mr. John Nakagawa, the following discussion is provided for your review to determine consistency of the proposed activities with the Coastal Zone Management Act. Your concurrence with our determination that the Proposed Action is consistent to the maximum extent practicable with the objectives and policies of the State of Hawaii Coastal Zone Management Program is requested.

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06 DEC 1993

Recreational Resources: One proposed site is located within Kokee State Park, which is managed by the Department of Land and Natural Resources, Division of State Parks. The State Park includes Waimea Canyon, a primary tourist destination on Kauai. The MSSTIC Facility program would not affect public access to recreation areas within the park, or to Polihale State Park north of the PMRF. The Proposed Action would not conflict with the State of Hawaii's policy of providing coastal recreational opportunities accessible to the public or of protecting coastal resources uniquely suited for recreational activities that cannot be provided elsewhere.

Historic Resources: Archaeological surveys have been performed at the PMRF-Kokee and PMRF-Makaha Ridge sites for prior programs. No historic or archaeological remains were discovered at either site. However, during the course of future development, if potentially significant cultural remain are encountered in the project area consultation will be initiated immediately. To date no sites included in the National Register of Historic Places have been recorded within the PMRF-Main Base. However, Hawaiian oral tradition and traditional burial patterns indicate that the dunes and adjacent sandy areas at the PMRF-Main Base can be considered areas of high sensitivity with the potential for containing human remains. An archaeological survey will be performed prior to any ground disturbance on PMRF-Main Base. The Proposed Action would not conflict with the State of Hawaii's policy to protect, preserve, and, where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Scenic and Open Space Resources: The PMRF-Kokee site is located within the boundaries of Kokee State Park, and the facility will have limited visibility from points along Highway 550. However, given the existing visual environment in those areas of the highway, an existing 30-foot antenna/pedestal, and prominent utility poles and lines, the MSSTIC Facility is expected to have minimal impact. The tower that is proposed for PMRF-Kokee would be galvanized steel that has oxidized to a dull finish, thus reducing reflectivity and minimizing visual impacts. After consultation with State Parks, the existing white buildings would be painted dark brown, which would further minimize visual impacts. PMRF-Makaha Ridge would be used as is. Site preparation and construction of new buildings at the PMRF-Main Base may involve the installation of alarms and lighting as well as the placement of mobile equipment, however most of the PMRF is effectively screened from the public by the vegetation along the eastern boundary, and thus no adverse impact to visual resources is anticipated. The Proposed Action would not conflict with the State of Hawaii's policy to protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.

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06 DEC 1998

Coastal Ecosystems: Two federally endangered species of plants, Ohia (*Sesbania tomentosa*) and Lau'ehu (*Panicum nihausense*), have been observed north of PMRF-Main Base, however, neither has been observed on the base.

Seven federally listed or state-listed threatened and endangered wildlife species are known to exist in the vicinity of the proposed MSSTIC Facility program sites. These include the 'Alae-ke'oke'o (*Fulica americana alai*) (American/Hawaiian Coot); Ae'o (*Humanotopos mexicanus knudseni*) (Hawaiian black-necked stilt); 'Alae-'ula (*Gallinula chloropus sandvicensis*) (Hawaiian Gallinule/common moorhen); Koloa-maoli (*Anas wyvilliana*) (Hawaiian duck); A'o (*Puffinus newelli*) (Newell's shearwater); Pueo (*Asio flammeus sandwichensis*) (Hawaiian short-eared owl); Hawaiian dark-rumped petrel (*Pterodroma phaeopygia sandwichensis*); Ne ne (*Nesochen sandvicensis*) and the Hawaiian hoary bat (*Lasiorus cinereus semotus*). The proposed security lighting at the sites would be designed to deflect downward to minimize adverse impacts to the Newell's shearwater, a threatened native seabird which may fly over the sites.

The probability of adversely impacting marine mammals known to be present in the ocean fronting the PMRF, such as the Hawaiian monk seal and humpback whale, and the green sea turtle, is considered negligible.

Operation of the tracking radars is not expected to adversely affect birds in the area. Birds would have to either hover in the main beam or fly right down the main beam's path to be exposed to harmful levels of EMR - both highly unlikely scenarios.

The Proposed Action would not conflict with the State of Hawaii's policy to protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Economic Uses: The proposed MSSTIC Facility program would take full advantage of existing facilities on the PMRF, that is, sites presently designated and used for such purposes. The program would also have a cumulative positive net economic impact to Kauai and the State through both direct program-related procurements and direct and indirect personnel expenditures. The Proposed Action would not conflict with the State of Hawaii's policy to provide public or private facilities and improvements important to the State's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone.

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Ser 7031.5A/ 0906
06 DEC 1999

Coastal Hazards: Although some areas of the PMRF have been affected by tsunamis in the past, the proposed MSSTIC Facility locations are not located within a potential tsunami or flood inundation area. Additionally, there is a tsunami evacuation plan in effect. The surrounding ground is composed of granular sand and coral which allows for rapid percolation of rainfall and surface runoff waters. Also, there is no historical experience that the proposed project site has been flooded. The Proposed Action would not conflict with the State of Hawaii's policy to reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

Managing Development: The MSSTIC Facility program sites at the PMRF are located on property controlled by the Federal Government. Neither County nor State jurisdictions apply in this area.

An EA for the program is currently in preparation. The public will be notified of the proposed activity with release of the EA for public comment, in accordance with Chief of Naval Operations Instruction 5090.1B.

The Proposed Action would not conflict with the State of Hawaii's policy to improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Public Participation: The public will have the opportunity to comment on the Proposed Action during the EA public review period. The Proposed Action would not conflict with the State of Hawaii's policy to stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM program.

Beach Protection: Any new construction on PMRF-Main Base would be located inland south of the existing Hawaii Air National Guard facility. The Proposed Action would not conflict with the State of Hawaii's policy to protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion.

Marine Resources: All activities for this project are land-based and therefore would have no effect on marine species. The Proposed Action would not conflict with the State of Hawaii's policy to implement the State's ocean resources management plan.

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Ser 7031.5A/ 0906
06 DEC 1999

A description of the Proposed Action can be found in the attached Coordinating Draft EA. If you have any questions, please contact Mr. Averiet Soto, (808) 335-4775 or Mr. David Anderson (808) 335-4823.

Sincerely,



M. B. HARRISON
Lieutenant, CEC, U.S. Navy
Public Works Officer
By direction of the
Commanding Officer

Encl:

(1) Coordinating Draft Environmental
Assessment Mountaintop Surveillance
Sensor Test Integration Center Facility,
Kauai, Hawaii



DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
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BENJAMIN J. CAVETAN
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DAVID W. BLAN
DIRECTOR, OFFICE OF PLANNING

Telephone: (808) 587-2844
Fax: (808) 587-2844

Ref. No. P-8432

January 18, 2000

700 JAN 21 P 3:01

West 330

297

M. B. Harrison
Lieutenant, CEC, U.S. Navy
Public Works Officer
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Hawaii 96752-0128

1-5 _____
1-5A _____
1-5B _____
1-5C _____

Dear Lieutenant Harrison:

Subject: Hawaii Coastal Zone Management (CZM) Program Federal Consistency Review for the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility at Kokee, Makaha Ridge and the Main Base, Kauai

The Department of the Navy's proposal for establishing the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) Facility at the Pacific Missile Range Facility at Kokee, Makaha Ridge and the Main Base has been reviewed for consistency with Hawaii's CZM Program. We concur with the U.S. Navy's CZM consistency determination that the proposed activity is consistent to the maximum extent practicable based on the following conditions.

1. Cultural Resources. As stated in Captain J. A. Bowlin's letter of October 13, 1999, to Timothy Johns, State Historic Preservation Officer, prior to any ground disturbing activities on the 0.4-hectare (1-acre) site at PMRF-Main Base proposed for construction of facility support buildings, an archaeological survey by diagonal trenching will be done to ensure that cultural resources are not affected. In addition, archaeological monitoring of the disturbed areas will be conducted. (*Coordinating Draft Environmental Assessment*, August 1999, Appendix B.)
2. Lighting. To minimize the potential for security lighting to disorient the Newell's shearwater, a threatened species of native bird, U.S. Fish and Wildlife Service approved lighting designed to be deflected downward will be used at PMRF-Kokee and PMRF-Makaha Ridge. Also, any outdoor lighting associated with construction activities at PMRF-Main Base will be properly shielded in accordance with U.S. Fish and Wildlife Service guidelines to avoid attracting Newell's shearwaters. (*Coordinating Draft Environmental Assessment*, August 1999, section 4.1.2, 4.2.2, 4.3.2.)

M.B. Harrison
Page 2
January 18, 2000

3. Returning Sites To Existing Conditions. When testing is completed at PMRF-Kokee, the radar equipment and tower would be disassembled and moved to PMRF-Makaha Ridge, and the site would be returned to its existing condition. At PMRF-Makaha Ridge, the antenna to be mounted on the existing tower will be removed after the testing period and the site returned to its original condition. It is our understanding that the project is expected to last through 2006 with follow-on testing possible up until 2010. (*Coordinating Draft Environmental Assessment*, August 1999, sections 2.1, 2.1.2.1, 2.1.2.2.)
4. Scenic and Open Space Resources. As stated in the CZM consistency determination, dated December 6, 1999, the tower proposed for PMRF-Kokee will be galvanized steel that has oxidized to a dull finish, thus reducing reflectivity and minimizing visual impacts. To further minimize visual impacts, the existing white buildings will be painted dark brown.

CZM consistency concurrence is not an endorsement of the project nor does it convey approval with any other regulations administered by any State or County agency. Thank you for your cooperation in complying with Hawaii's CZM Program. If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

Sincerely,



David Blane
Director
Office of Planning

c: U.S. National Marine Fisheries Service, Pacific Area Office
U.S. Fish and Wildlife Service, Pacific Islands Ecoregion
Department of Land & Natural Resources,
Planning & Technical Services Branch
Historic Preservation Division
Planning Department, County of Kauai
Ms. Brenda Lei Foster, Governor's Office

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Appendix D
EMI/EMC Analysis



DEPARTMENT OF THE NAVY

SPACE AND NAVAL WARFARE SYSTEMS ACTIVITY PACIFIC
875 LEHUA AVENUE
PEARL CITY, HAWAII 96782-3356

IN REPLY REFER TO:

2000

Ser D9132SK/237

02 JUL 1999

From: Officer in Charge, Space and Naval Warfare Systems Activity Pacific
To: Commander, Pacific Missile Range Facility (Codes 7030, 7070, 7322, 7324, 7325, 7330, and 7332)

Subj: ELECTROMAGNETIC RADIATION HAZARDS AND ELECTROMAGNETIC COMPATIBILITY STUDY FOR THE ENVIRONMENTAL ASSESSMENT OF THE REINSTALLATION OF THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION CENTER IN SUPPORT OF THE UHF ELECTRONICALLY SCANNED ARRAY ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION KOKEE TRACKING STATION AND THE PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII; (E3 PROGRAM TASK NO E99-H009)

Ref: (a) CNR Hawaii N0534A99WR3R325 of 17 May 1999 (NOTAL)
(b) Meeting between PMRF (Mr. A. Soto)/SPAWAR SYSACT PAC (Mr. S. Kobashigawa of 2 June 1999
(c) MIL-STD-461D, *Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility* dated 11 January 1993

Encl: (1) Technical Report of the Electromagnetic Radiation (EMR) Hazards and Electromagnetic Compatibility (EMC) Study for the Environmental Assessment (EA) of the Reinstallation of the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) in Support of the UHF Electronically Scanned Array (UESA) Advanced Technology Demonstration (ATD) Program at the National Aeronautics and Space Administration (NASA) Kokee Tracking Station (NKTS) and the Pacific Missile Range Facility (PMRF), Kauai, Hawaii; (E³ Program Task No. E99-H009)

1. As tasked by PMRF via reference (a), Space and Naval Warfare Systems Activity Pacific (SPAWAR SYSACT PAC) conducted an EMR hazards and EMC study for the EA of the MSSTIC in support of the Office of Naval Research (ONR) UESA ATD Program managed by Naval Air Warfare Center Aircraft Division (NAWCAD). In this study, we consider the hazards of EMR to personnel (HERP) and fuel (HERF), radiated susceptibility (RS) related electromagnetic interference (EMI) to electronic equipment, and the EMC of the UESA ATD Program radars with existing radio frequency (RF) systems. Enclosure (1) provides a detailed technical report of the study. The UESA ATD Program will include:

a. The reinstallation and operation of the MSSTIC at Parcel "A" of the NKTS (also known as PMRF-Kokee). The MSSTIC will consist of the Radar Surveillance Technology Experimental Radar (RSTER) used with the UESA antenna.

SUBJ: ELECTROMAGNETIC RADIATION HAZARDS AND ELECTROMAGNETIC COMPATIBILITY STUDY FOR THE ENVIRONMENTAL ASSESSMENT OF THE REINSTALLATION OF THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION CENTER IN SUPPORT OF THE UHF ELECTRONICALLY SCANNED ARRAY ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION KOKEE TRACKING STATION AND THE PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII; (E3 PROGRAM TASK NO E99-H009)

b. The reinstallation and operation of the MSSTIC at PMRF-Makaha Ridge. The MSSTIC will include a new MSSTIC transmitter and the UESA antenna mounted on the existing tower installed by the Mountaintop Sensor Integration and Test Program (MSITP). The low power Inverse Displaced Phased Center Array (IDPCA) transmitting system also installed during the MSITP will be used during the UESA ATD Program testing.

c. As advised during reference (b), although the RSTER, MSSTIC, and IDPCA transmitters have frequency ranges of 406 to 450 MHz, the UESA ATD Program will use only 435 MHz, the primary test frequency used during the MSITP and the Advanced Concept Technology Demonstration of the Wide Area Defense (WAD) Program at Parcel "A", NKTS, and PMRF-Makaha Ridge. Additional EMC studies will be done if additional test frequencies are required.

2. The results of the study show that the proposed MSSTIC installations will not create significant EMR hazards or EMC problems.

a. EMR hazards problems due to transmissions from the MSSTIC sites can be avoided through the use of the proposed sector blanking described in enclosure (1).

However, between 2000 and 0600 hours local time, the proposed operational range of the MSSTIC at the NKTS will be expanded to a full 360° azimuth less a 15° sector centered at Parcel "C". All parcels (except Parcel "B", the power plant) will be beyond the calculated RS103 separation distance based on the criteria of reference (c). It is recommended that the proposed sector blanked zone of 15° be widened and specifically defined as the sector $\pm 20^\circ$ from a line between the UESA antenna to the Very Long Baseline Interferometry (VLBI) 20 meter dish at Parcel "E". This will place Parcel "B" beyond the calculated RS103 separation distance. The widening will further lower the possibility of EMI for electronic systems in Parcels "C", "D", and "E".

b. Potential adjacent channel and transmitter spurious emissions EMC problems to the reception of Command Guidance and Command Destruct (CG&CD) signals by rockets and missiles can be avoided by conducting compatibility testing prior to concurrent operations (these tests may have already been conducted during the MSITP and WAD Program testing). Cooperative scheduling should be employed should the MSSTIC transmissions interfere with the reception of the CG&CD signals.

c. No EMI is predicted for existing VHF and UHF radios due to the proposed operations of the RSTER and MSSTIC radar with the UESA antenna. These radios include those used by the

SUBJ: ELECTROMAGNETIC RADIATION HAZARDS AND ELECTROMAGNETIC COMPATIBILITY STUDY FOR THE ENVIRONMENTAL ASSESSMENT OF THE REINSTALLATION OF THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION CENTER IN SUPPORT OF THE UHF ELECTRONICALLY SCANNED ARRAY ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION KOKEE TRACKING STATION AND THE PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII; (E3 PROGRAM TASK NO E99-H009)

State of Hawaii VHF repeater system, the U.S. Coast Guard VHF Maritime National Distress System, and NOAA Weather Radio.

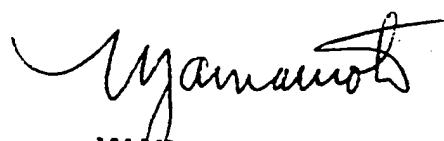
d. No EMI is predicted to the reception of the VLBI 20 meter antenna jointly used by NASA and the U.S. Naval Observatory. The UESA antenna installation at Parcel "A" will not impact the look angle of the VLBI antenna.

3. VLBI Cooperative Scheduling: The study does not predict any EMI to VLBI reception from the proposed MSSTIC installation at the NKTS. However, should EMI occur, it is recommended that the RSTER be silenced until the EMI problem can be eliminated. If no solution can be found, then it is recommended that operations of the RSTER be scheduled around VLBI operations. Local coordination can be done with Mr. Clyde Cox, the NASA Kokee Park Geophysical Observatory site manager at (808)335-6945 (commercial) or at a national level with Mr. William T. Wildes, the NASA VLBI Network Manager at (301)286-3332.

4. As with prior MSITP and WAD Program tests, it is recommended that all MSSTIC testing be coordinated through PMRF's Instrumentation Control Center (ICC) in Range Operations.

5. EMR Hazards and EMI Survey: It is recommended that an EMR hazards and EMI survey be conducted after the MSSTIC installations are completed. SPAWARSYSACT PAC is available to conduct the survey.

6. Our point of contact for this report is Mr. S. Kobashigawa, DSN (315) 471-1976 or COMM (808) 471-1976 and "koba@spawar.navy.mil" via e-mail.



W. YAMAMOTO
By direction

Copy to:

EDAW Inc (Mr. Edd Joy)

SMDC (SMDC-EN-V (Mr. Tom Craven)) 

ONR (ONR-313 (Ms. Mun-Won Fenton))

NAVAIRWARCEN AC DIV (Code 4.5.5 MSS (Two Copies))

NASA/Goddard Space Flight Center (Code 920.1 (Mr. J. Bosworth))

NASA Kokee Park Geophysical Observatory (Mr. Clyde Cox)

COMSPAWARSYSCOM (Code 051-E)

SPAWARSYSSEN Charleston SC (Code J323)

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TECHNICAL REPORT OF
THE ELECTROMAGNETIC RADIATION HAZARDS AND
ELECTROMAGNETIC COMPATIBILITY STUDY FOR
THE ENVIRONMENTAL ASSESSMENT OF THE REINSTALLATION
OF THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION
CENTER IN SUPPORT OF THE UHF ELECTRONICALLY SCANNED
ARRAY ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM
AT THE NASA KOKEE TRACKING STATION AND THE PACIFIC MISSILE
RANGE FACILITY, KAUAI, HAWAII;
E3 PROGRAM TASK NO E99-H009

July 1999

Prepared by:
Mr. Steve Kobashigawa

Space and Naval Warfare Systems Activity Pacific
675 Lehua Avenue
Pearl City, Hawaii 96782-3356

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B Free Space Propagation Formulas	B1

EXECUTIVE SUMMARY

A. Space and Naval Warfare Systems Activity Pacific (SPAWAR SYSTEMS ACTIVITY PAC) was tasked by the Pacific Missile Range Facility (PMRF) to conduct an electromagnetic radiation (EMR) hazards and electromagnetic compatibility (EMC) study for the Environmental Assessment (EA) of the reinstallation of the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) in support of the UHF Electronically Scanned Array (UESA) Advanced Technology Demonstration (ATD) Program at the National Aeronautics and Space Administration (NASA) Kokee Tracking Station (NKTS, also known as PMRF-Kokee) and PMRF-Makaha Ridge, on the Island of Kauai, Hawaii. The study considered the hazards of EMR to personnel (HERP) and fuel (HERF), radiated susceptibility (RS) related electromagnetic interference (EMI) to electronic equipment, and the EMC of the MSSTIC transmitters with existing radio frequency (RF) systems.

B. The UESA ATD Program is sponsored by the Office of Naval Research (ONR) and managed by the Naval Air Warfare Center Aircraft Division (NAWCAD). The UESA ATD Program will include:

1. The reinstallation and operation of the MSSTIC at Parcel "A", NKTS. The MSSTIC will consist of the Radar Surveillance Technology Experimental Radar (RSTER) used with the UESA antenna. The top of the UESA antenna will be 100 feet above ground level (AGL).

2. The reinstallation and operation of the MSSTIC at PMRF-Makaha Ridge. The MSSTIC will include a new MSSTIC radar and the UESA antenna mounted on the existing tower installed by the Mountaintop Sensor Integration and Test Program (MSITP). The low power Inverse Displaced Phased Center Array (IDPCA) transmitter and antenna also installed during the MSITP will be used during the UESA ATD Program testing.

3. As advised during a meeting between PMRF (Mr. A. Soto) and SPAWAR SYSTEMS ACTIVITY PAC (Mr. S. Kobashigawa) on 2 June 1999, although the RSTER, MSSTIC, and IDPCA transmitters have frequency ranges of 406 to 450 MHz, the UESA ATD Program will use only 435 MHz, the primary test frequency used during the MSITP and the Advanced Concept Technology Demonstration of the Wide Area Defense (WAD) Program at PMRF-Makaha Ridge and Parcel "A", NKTS. Additional EMC studies will be done if additional test frequencies are required.

C. The results of the study show that the proposed MSSTIC installations will not create significant EMR hazards or EMC problems.

D. **EMR Hazards Summary:** EMR hazards problems due to transmissions from the MSSTIC sites can be avoided through the use of sector blanking as recommended in the report.

1. HERP: The AN/FPQ-10 antenna platforms at PMRF-Makaha Ridge are high enough to be within the main beam of the UESA antenna and are within the calculated HERP separation distance. However, the platforms fall within the blanked sector of the UESA antenna so that no main beam transmissions will be made in the direction of the platforms.

2. No HERF problems are predicted.

3. MIL-STD-461 RS103 Related EMI:

a. Ground Electronic Equipment:

(1) MSSTIC at Parcel "A", NKTS: Between 2000 and 0600 hours local time, the operation range will be expanded to a full 360° azimuth less a 15° sector centered at Parcel "C". Parcels "C", "D", and "E" will all lie just at 7.5° from boresight of the UESA antenna. All parcels (except Parcel "B", the power plant) will be beyond the calculated MIL-STD-461D RS103 separation distance. It is recommended that the proposed sector blanked zone of 15° be widened and specifically defined as the sector $\pm 20^\circ$ from a line between the UESA antenna to the Very Long Baseline Interferometry (VLBI) 20 meter dish at Parcel "E". This will place Parcel "B" beyond the calculated RS103 separation distance. The widening will further lower the possibility of EMI for electronic systems in Parcels "C", "D", and "E".

(2) MSSTIC at PMRF-Makaha Ridge: During prior tests with the RSTER transmitter and ADS-18S antenna, electronic equipment in Building 770 (EW) and Building 715 (AN/SPS-48E and AN/APS-134) experienced severe RS EMI when the ADS-18S was pointed at 0° azimuth (directly over the buildings). No RS EMI were visible when the ADS-18S antenna was pointed at 350° azimuth. After the installation of the MSSTIC at PMRF-Makaha Ridge, an EMI test should be conducted with the UESA antenna pointed at 350° azimuth to determine if RS related EMI will occur. If EMI is experienced, then either the output power of the MSSTIC radar or the operating sector can be reduced.

b. External and Safety Critical Aircraft Electronic Equipment: The zones in which the calculated electric (E)-field levels will exceed the RS103 criteria do not extend into areas normally used by military aircraft.

4. Federal Aviation Administration (FAA) High Intensity Radiated Field (HIRF) *Certification* Level Related EMI: The zones in which the calculated E-field levels will exceed the HIRF *Certification* levels do not extend into areas used by civil aircraft.

E. EMC Analysis Summary

1. Adjacent channel and transmitter spurious emissions EMI are predicted to the reception of Command Guidance and Command Destruct (CG&CD) signals between 400 and 450 MHz by rockets and missiles. To avoid EMI problems to the CG&CD signal reception on the rockets and missiles, it is recommended that compatibility testing be conducted prior to concurrent operations (these tests may have already been conducted during the MSITP and WAD Program testing). Cooperative scheduling should be employed should the MSSTIC transmissions interfere with the reception of the CG&CD signals.

2. No EMI is predicted for existing VHF and UHF radios due to the proposed operations of the RSTER and MSSTIC radar with the UESA antenna. These radios include those used by the State of Hawaii VHF repeater system, the U.S. Coast Guard VHF Maritime National Distress System, and NOAA Weather Radio.

3. No EMI is predicted to the reception of the VLBI 20 meter antenna jointly used by NASA and the U.S. Naval Observatory. The UESA antenna installation at Parcel "A" will not impact the look angle of the VLBI antenna.

4. No EMI is predicted to the reception of the MK-74 Guided Missile Fire Control System recently installed at Parcel "A" in support of the U.S. Navy's Theater Ballistic Missile Defense and Department of Defense Theater Missile Defense exercises. The UESA antenna installation at Parcel "A" will not impact the look angle of the MK-74 antenna.

F. VLBI Cooperative Scheduling: The study does not predict any EMI to VLBI reception from the MSSTIC installation planned for the NKTS. However, should EMI occur, it is recommended that the RSTER be silenced until the EMI problem can be eliminated. If no solution can be found, then it is recommended that operations of the RSTER be scheduled around VLBI operations. Local coordination can be done with Mr. Clyde Cox, the NASA Kokee Park Geophysical Observatory site manager at (808)335-6945 (commercial) or at a national level with Mr. William T. Wildes, the NASA VLBI Network Manager at (301)286-3332.

G. As with prior MSITP and WAD Programs tests, it is recommended that all MSSTIC testing be coordinated through PMRF's Instrumentation Control Center (ICC) in Range Operations.

GLOSSARY

AGL: Above Ground Level

AMSL: Above Mean Sea Level

ATD: Advanced Technology Demonstration

CE: Controlled Environments (from DoD INST 6055.11): Areas where exposure may be incurred by personnel who are aware of the potential for RF exposures as a concomitant of employment or duties, exposure of individuals who knowingly enter areas where higher RF levels can reasonably be anticipated to exist, and exposure that may occur incidental to transient passage through such areas. Typically, for military sites, controlled environments include all operational and work areas.

CG&CD: Command Guidance and Command Destruct (Rocket and Missile Control Signals)

CNR Hawaii: Commander, Naval Region Hawaii

dBc: Decibels referenced to the carrier signal.

dBi: Decibels referenced to an isotropic antenna.

dBm: Decibels referenced to a milliwatt.

DoD: Department of Defense

EMC: Electromagnetic Compatibility

EMI: Electromagnetic Interference

EMR: Electromagnetic Radiation

FAA: Federal Aviation Administration

FCC: Federal Communications Commission

GMFCS: Guided Missile Fire Control System (MK-74, to be used in the TBMD exercises)

GP/UE: General Population/Uncontrolled Exposure (from FCC 96-326). Applies to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or can not exercise control over their exposure.

HERF: Hazards of Electromagnetic Radiation to Fuel (Based on OP-3565 Vol I Fifth Revision of 15 July 1982, *Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel and Other Flammable Material)*)

HERP: Hazards of Electromagnetic Radiation to Personnel (Based on DoD INST 6055.11, *Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers* of 21 February 1995)

HANG: Hawaii Air National Guard

HIRF: High Intensity Radiated Field

ICC: Instrumentation Control Center (ICC)

IDPCA: Inverse Displaced Center Array (Low Power Pulse Transmitting System)

MPE: Maximum Permissible Exposure (Based on FCC 96-326, *Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, dated 1 August 1996)

MSITP: Mountaintop Sensor Integration and Test Program

MSSTIC: Mountaintop Surveillance Sensor Test Integration Center

mW/cm²: Milliwatt per square centimeter (Unit of RF power density)

NASA: National Aeronautics and Space Administration

NAWCAD: Naval Air Warfare Center Aircraft Division

NKTS: NASA Kokee Tracking Station (also know as PMRF-Kokee)

NDS: National Distress System (VHF Maritime Radio System run by the U.S. Coast Guard)

NOAA: National Oceanic and Atmospheric Administration

O/CE: Occupational/Controlled Exposure (from FCC 96-326). Applies to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure will also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above the GP/UE limits, as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

ONR: Office of Naval Research

PEL: Permissible Exposure Limit (from on DoD INST 6055.11)

PMRF: Pacific Missile Range Facility

R3101: Restricted airspace controlled by PMRF (from 0600 to 1800 hours, Monday through Friday) shown on the NOAA *Hawaiian Island Sectional Aeronautical Chart* as extending up to three miles off of the coast of portions of Western Kauai.

RF: Radio Frequency

RS: Radiated Susceptibility (Based on MIL-STD-461D, *Requirements for the Control of Electromagnetic Interference Emissions and Susceptibility* dated 11 January 1993)

RSTER: Radar Surveillance Technology Experimental Radar

SFAR-71: Special Federal Aviation Regulation (SFAR)-71 (FAA established rules governing the minimum flight altitudes of fixed wing aircraft and helicopters.)

SOH: State of Hawaii

TBMD: Theater Ballistic Missile Defense

TMD: Theater Missile Defense

UCE: Uncontrolled Environments (from DoD INST 6055.11): Public areas where individuals have no knowledge or control of their exposure. Such areas include living quarters, workplaces, or public areas where there are no expectations that higher RF levels should exist.

UESA: UHF Electronically Scanned Array (An array antenna consisting of 54 elements installed on the outer edge of a 24 foot diameter disc. The array eliminates the need for physical rotation.)

UHF: Ultra High Frequency (normally 300 to 3,000 MHz, but occasionally starts at 200 MHz when referencing Government radios).

USNO: U.S. Naval Observatory

VLBI: Very Long Baseline Interferometry (Extra-galactic RF Signal Receiving System Jointly Operated by NASA and USNO)

VHF: Very High Frequency (Normally 30 to 300 MHz, but occasionally stops at 200 MHz when referencing Government radios).

V/m: Volt/meter (Unit of RF Electric (E)-fields)

WAD: Wide Area Defense

ELECTROMAGNETIC RADIATION HAZARDS AND ELECTROMAGNETIC COMPATIBILITY STUDY FOR THE ENVIRONMENTAL ASSESSMENT OF THE REINSTALLATION OF THE MOUNTAINTOP SURVEILLANCE SENSOR TEST INTEGRATION CENTER IN SUPPORT OF THE UHF ELECTRONICALLY SCANNED ARRAY ADVANCED TECHNOLOGY DEMONSTRATION PROGRAM AT THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION KOKEE TRACKING STATION AND THE PACIFIC MISSILE RANGE FACILITY, KAUAI, HAWAII

I. INTRODUCTION

A. Space and Naval Warfare Systems Activity Pacific (SPAWAR/SYSACT PAC) was tasked by the Pacific Missile Range Facility (PMRF) via Commander, Navy Region Hawaii (CNR) Hawaii N0534A99WR3R325 of 17 May 1999 to conduct an electromagnetic radiation (EMR) hazards and electromagnetic compatibility (EMC) study for the environmental assessment (EA) of the reinstallation of the Mountaintop Surveillance Sensor Test Integration Center (MSSTIC) in support of the UHF Electronically Scanned Array (UESA) Advanced Technology Demonstration (ATD) Program at the National Aeronautics and Space Administration (NASA) Kokee Tracking Station (NKTS) and PMRF-Makaha Ridge, on the Island of Kauai, Hawaii. The UESA ATD Program is sponsored by the Program Office of Naval Research (ONR) and managed by Naval Air Warfare Center Aircraft Division (NAWCAD).

1. The MSSTIC at Parcel "A", NKTS (also known as PMRF-Kokee) will include the installation and operation of the Radar Surveillance Technology Experimental Radar (RSTER) and the UESA antenna. The RSTER has been operated at Parcel "A" from 1994 through 1996 as part of the Mountaintop Sensor Integration and Test Program (MSITP) and the Advanced Concept Technology Demonstration of the Wide Area Defense (WAD) Program. Antennas used in these tests included the RSTER planar array and ADS-18S. The UESA antenna is very similar in appearance to the ADS-18S but will use a circular array of elements to eliminate the need for physical rotation.

2. The MSSTIC at PMRF-Makaha Ridge will include the installation and operation of a new MSSTIC radar (under development) and the UESA antenna. The RSTER, and RSTER planar array and ADS-18S antennas have been operated at Makaha Ridge from 1994 through 1998 as part of the MSITP. The MSITP also employed a low power Inverse Displaced Phased Center Array (IDPCA) transmitting system at Makaha Ridge. The IDPCA will also be part of the MSSTIC at Makaha Ridge.

B. Objective: The EMR hazards study analyzes the hazards of EMR to personnel (HERP), fuel (HERF), and electronic equipment (due to levels exceeding radiated susceptibility (RS) limits of the equipment and causing electromagnetic interference (EMI)) that could be created by the radar transmissions from the MSSTIC sites. The EMC study analyzes the potential EMI problems to current radio frequency (RF) users that the radar transmissions from the MSSTIC sites could create and vice versa. The study provides recommendations to mitigate predicted HERP, HERF, and RS and EMC EMI problems.

II. EXISTING SYSTEMS (See Figure 1 for Site Location):

A. PMRF-Barking Sands: PMRF and its tenants operate numerous medium, high, very high, ultra high, and super high frequency (HF, VHF, UHF, and SHF) systems at Barking Sands including communications, electronic warfare systems, NAVAIDS, radar, telemetry, vehicle guidance, and weather systems. PMRF also operates an airfield used by the DoD and other Federal agencies.

B. PMRF-Makaha Ridge: PMRF operates VHF, UHF, and SHF systems at Makaha Ridge including radar, communications, electronic warfare, telemetry, and vehicle control systems. Makaha Ridge has a helicopter landing pad used primarily by PMRF's UH-3H's and U.S. Marine Corp (USMC) CH-53D's. Occasionally, a private helicopter leased by PMRF (Niihau Ranch's Agusta-109) will use the pad. (See Figure 2).

C. NASA Kokee Tracking Station:

1. NASA operates numerous systems at Parcels "D" and "E", see Figure 3. The most visible system is the Very Long Baseline Interferometry (VLBI) system which uses a 20 meter dish (installed by the U.S. Naval Observatory (USNO)) to collect S-band (2.2 to 2.4 GHz) and X-band (8.2 to 9.0 GHz) extra-galactic signals. Numerous other systems are operated by NASA at Parcels "D" and "E" and are described in Appendix A.

2. PMRF has numerous communications, tracking, and vehicle guidance systems at Parcel "C" (the Kokee communications site), and telemetry receiving and tracking radars at Parcel "D". PMRF has communications equipment and a MK-74 Guided Missile Fire Control System (GMFCS, to be used for the Theater Ballistic Missile Defense Program) at Parcel "A".

3. Other agencies with radio systems at NKTS include the State of Hawaii (SOH) Forestry Service VHF repeater system, the National Oceanic and Atmospheric Administration (NOAA) weather radio system, the USCG VHF Maritime National Distress System (NDS), and the Hawaii Air National Guard (HIANG) microwave radios. Most of these systems are located at Parcel "C" and two are located at Parcel "A".

D. Kokee Air Force Station (KAFS): HIANG's 150th Aircraft Control and Warning Squadron (ACWS) mans KAFS. The primary system at KAFS is the AN/FPS-117 L-band air surveillance radar (ASR) which is part of the Federal Aviation Administration's (FAA's) air traffic control system. Numerous other HF, VHF, UHF, and SHF communications systems are located at the KAFS including several for PMRF.

III. MSSTIC SYSTEMS

A. RSTER: The RSTER is a UHF (406 to 450 MHz) air surveillance and tracking radar. It uses fourteen separate channels to output combined peak and average powers of 140 kilowatts (kW) and 8.4 kW at the transmitter flange, respectively. Table 1 lists its specifications. The

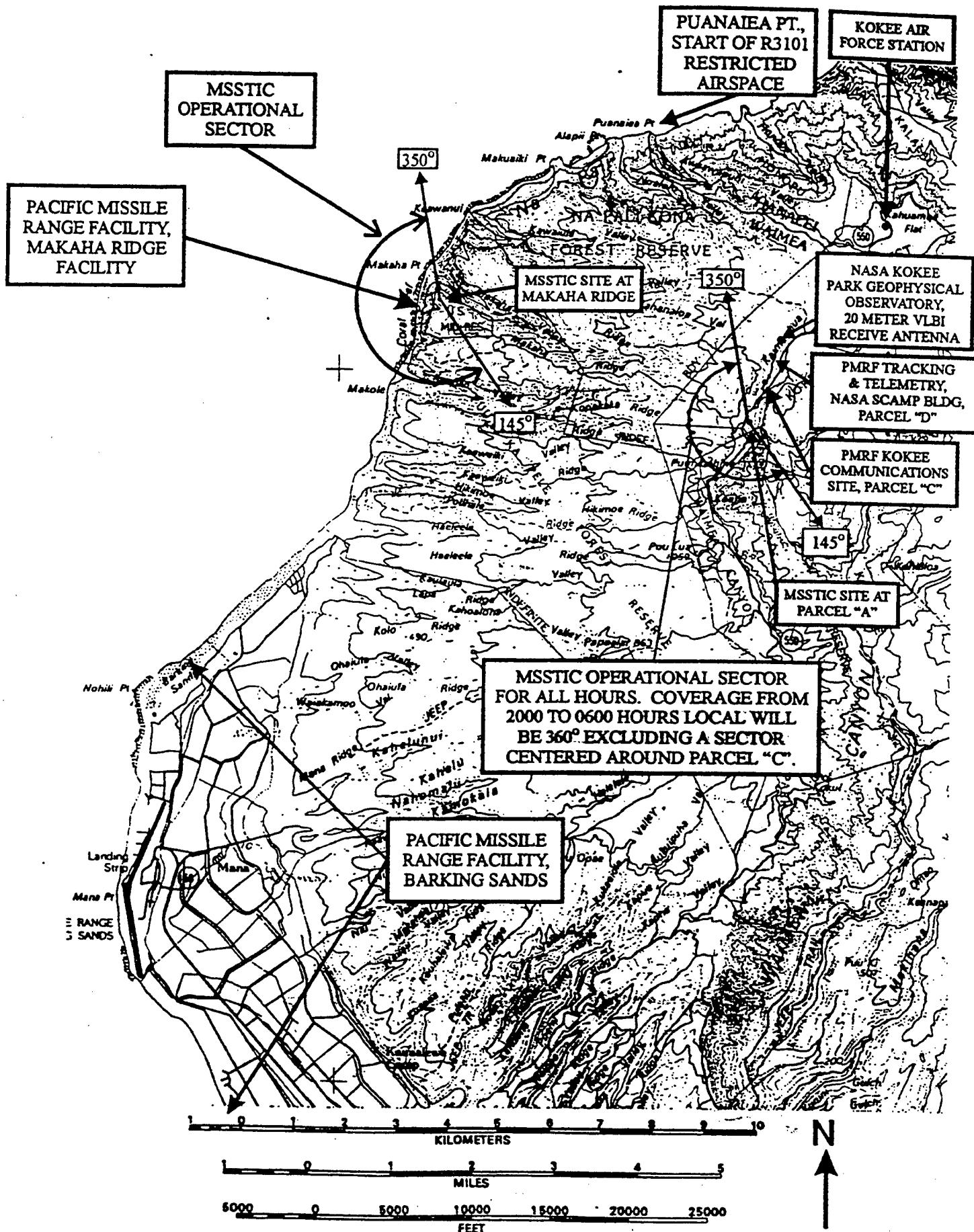


Figure 1. Map of Western Kauai Showing the Locations of PMRF and Other Operational Sites, and the Proposed Locations of the MSSTIC Sites

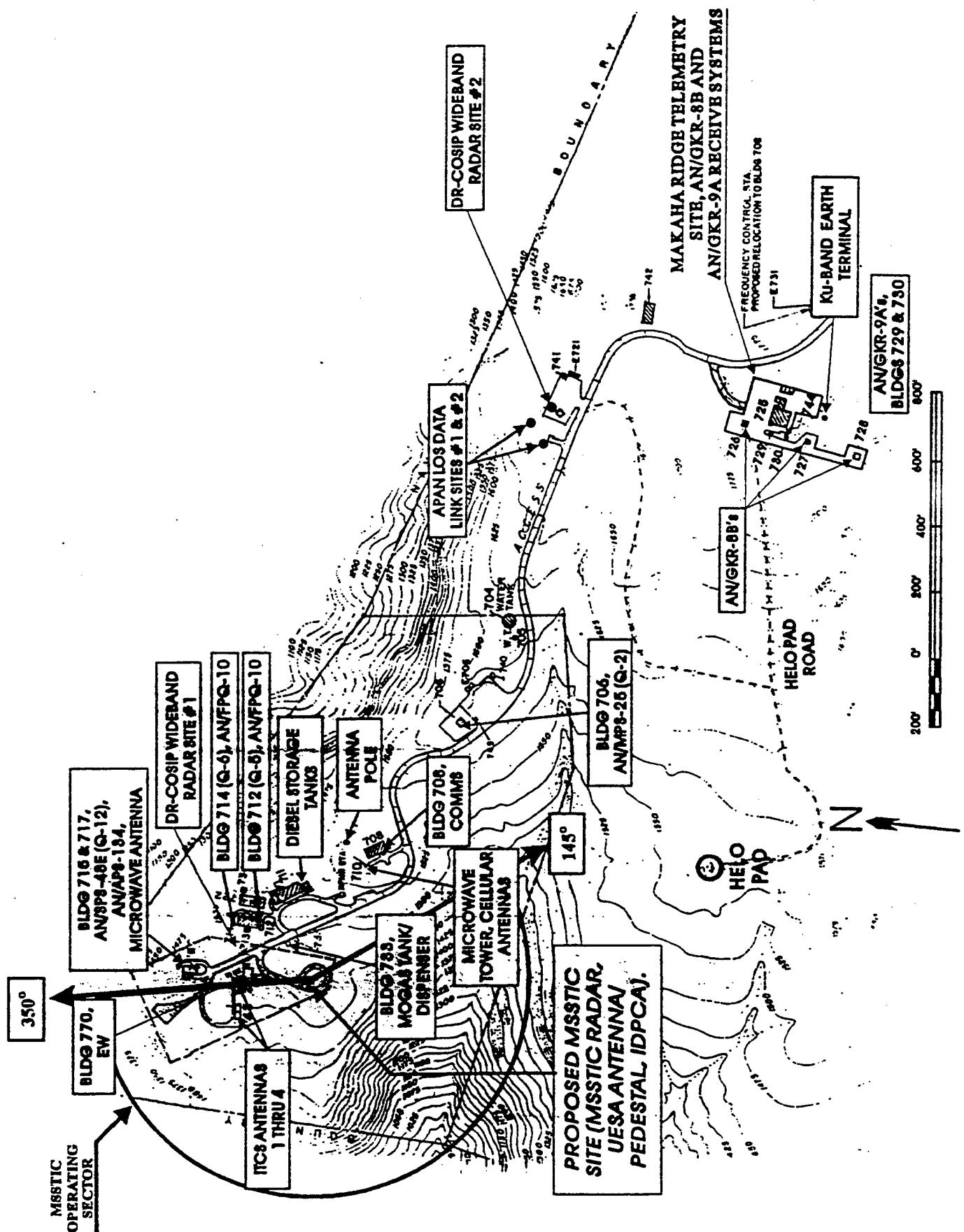


Figure 2. Partial Map of PMRF's Makaha Ridge Facility

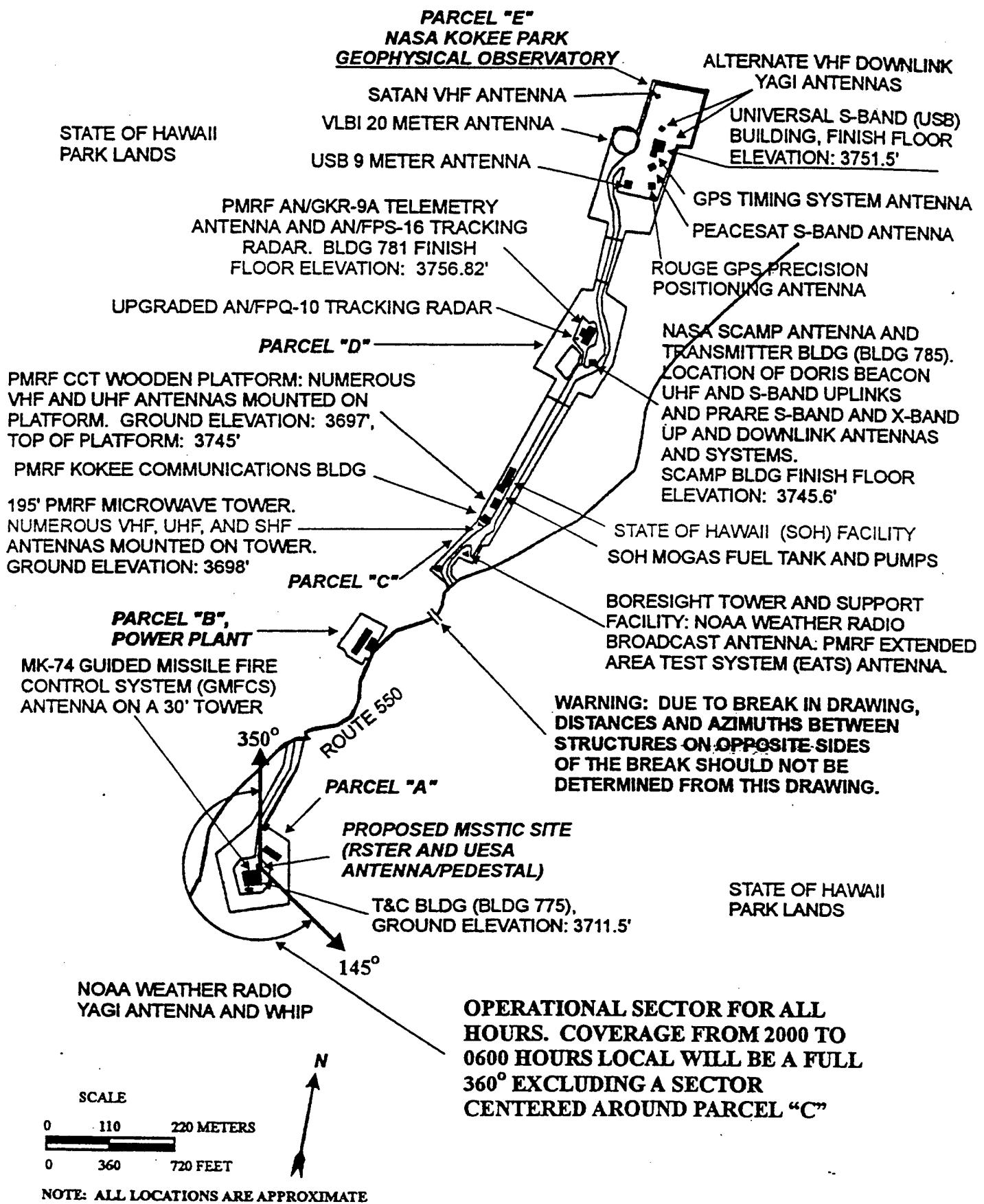


Figure 3. Map of the NASA Kokee Tracking Station (NKTS, Also Known as PMRF Kokee) Showing the RF Systems at Parcels "A" through "E"

Table 1. RSTER Equipment Specifications

Transmitter	Silicon Amplifier Class C
Transmit Frequency	406 - 450 MHz (Limited to 435 MHz. Use of additional frequencies to be preceded by an EMC study)
Receive Frequency	406 - 450 MHz
Transmit Power	140 kW (See Note 1)
Transmit Power	8.4 kW
Transmit 2 nd Harmonic	-80dBc (See Note 2)
Transmit 3 rd Harmonic	-80dBc
Transmit Spurious Emissions	-80 dBc
Pulse Repetition Frequency (PRF)	300 Hz (Typical) 1200 Hz (Maximum)
Pulse Width	200 microseconds @ 300 Hz PRF, 6% Duty Factor
Antenna	UHF Electronically Scanned Array (UESA)
Gain	19.7 dBi
Antenna Size	24 foot diameter by 30 inch height
Horizontal Beamwidth	9.7°
Elevation Beamwidth	33°
Elevation Sidelobe Gain	-20 dB relative mainbeam
Azimuth Sidelobe Gain	-11 dB relative mainbeam (Uniform Taper) and -23 dB relative mainbeam (MSL Taper)
Backlobe Gain	-33 dB relative mainbeam
Elevation Angle of Operation (Fixed)	0°
Site and Azimuth Angle of Operation	PMRF-Kokee: 145°-350° Unrestricted 360° minus 15°sector centered on NASA for hours of 2000-0600

Note 1

- Power specified passes through 110 feet of 7/8 Heliax estimated at 1dB-cable losses.
- Power specified pass through a 1:3 switch matrix, estimated loss is 1 dB
- Power specified pass through a rotary joint with an estimated loss of 0.5 dB

Note 2

- Estimate that antenna will filter 2nd Harmonic by an additional 30dB
- Estimate that antenna will filter 3rd Harmonic by an additional 20 dB

RSTER along with the UESA antenna will only be operated at Parcel "A", NKTS.

The proposed azimuths of operation will be 145° to 350° during all hours. From 2000 to 0600 hours local time, the azimuths of operation will be expanded to a full 360° minus a 15° blanked sector centered on Parcel "C", NKTS.

B. MSSTIC Radar: The MSSTIC is also a UHF (406 to 450 MHz) air surveillance and tracking radar. The MSSTIC radar will use twenty seven separate channels to output combined peak and average powers of 270 kW and 16.2 kW at the transmitter flange, respectively. Its specifications are listed on Table 2. The MSSTIC radar will only be operated at PMRF-Makaha Ridge.

C. UESA Antenna: The UESA antenna consist of an array of 54 elements installed at the outer edge of a disc shaped antenna 24 feet in diameter and 2.5 feet high. The transmitted output and received signals of the elements are combined to form the antenna's beam. The UESA will have different horizontal gain patterns when fed by the RSTER or MSSTIC radar due to the different amount of channels use by each radar. See Tables 1 and 2 for the UESA antenna specifications when used with each transmitter. Figures 4 and 5 show the horizontal antenna patterns for the UESA antenna when it is being fed by the RSTER and the MSSTIC radar, respectively. The vertical antenna pattern will be almost identical for both radars and is shown on Figure 6.

D. IDPCA: The fixed linear array radar transmitting system consists of an SD1568HI transmitter and a PATCH 1 linear array antenna. The transmitter is actually one of the RSTER's spare high power linear amplifiers. See Table 3 for the IDPCA technical specifications. The IDPCA will only be used where it is being used now, at the existing RSTER site at Makaha Ridge.

IV. ELECTROMAGNETIC RADIATION HAZARDS

A. HERP: The hazards associated with exposure to RF radiation are due to thermal heating, RF shocks, and RF burns. The Department of Defense Instruction (DoDI) 6055.11, *Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers*, of 21 February 1995 provides HERP guidance for DoD civilian and military personnel. Its exposure limits are based on the Institute of Electrical and Electronics Engineers (IEEE) C95.1-1991 *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz - 300 GHz*, dated 27 April 1992 (normally referred to as the ANSI/IEEE C95.1-1992 standards). Chapter 22 of the latest release of OPNAVINST 5100.23E has been revised to conform to DoDI 6055.11. However, OPNAVINST 5100.23E is currently in printing and has not been officially distributed. The Federal Communications Commission (FCC) 96-326, *Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation*, dated 1 August 1996, provides HERP guidance for non-DoD communities. The FCC 96-326 and DoDI 6055.11 criteria are identical for the MSSTIC radar frequencies but do differ in other frequency ranges.

Table 2. MSSTIC Radar Equipment Specifications

Transmitter	Silicon Carbide Amplifier Class AB
Transmit Frequency	406 – 450 MHz (Limited to 435 MHz. Use of additional frequencies to be preceded by an EMC study)
Receive Frequency	406 – 450 MHz
Transmit Power	270 kW (See Note 1)
Transmit Power	16.2 kW
Transmit 2 nd Harmonic	-30 dBc (See Note 2)
Transmit 3 rd Harmonic	-50 dBc
Transmitter Spurious Emissions	-80 dBc
Pulse Repetition Frequency (PRF)	300Hz (Typical), 1200 Hz (Maximum)
Pulse Width	200 microseconds @ 300 Hz PRF (6% Duty Factor)
Antenna	UHF Electronically Scanned Array (UESA)
Gain	21 dBi
Antenna Size	24 foot diameter by 30 inch height
Horizontal Beamwidth	6.4°
Elevation Beamwidth	32°
Elevation Sidelobe Gain	-23 dBmainbeam
Azimuth Sidelobe Gain	-11 dBmainbeam (Uniform) and -23 dBmainbeam (Tapered)
Backlobe Gain	-32 dB relative mainbeam
Minimum Elevation Angle of Operation (Fixed)	0°
Azimuth Angle of Operation	PMRF-Makaha: 145°- 350°

Note 1

- Power at the output of Power Amplifier, 110 feet of 7/8 Heliax estimated at 1dB-cable losses.
- Power must pass through a 1:3 switch matrix, estimated loss is 1 dB
- Power must pass through a rotary joint with an estimated loss of 0.5 dB

Note 2

- Estimate that antenna will filter 2nd Harmonic by 30dB
- Estimate that antenna will filter 3rd Harmonic by 20 dB

Table 3. IDPCA Equipment Specifications

Transmitter	SD1568HI
Transmit Frequency	400 – 500 MHz
Receive Frequency	Transmit Only
Transmit Power (Peak) at Antenna	600 Watts
Transmit Power (Average) at Antenna	37.5 Watts
Pulse Width	200 microseconds
Pulse Repetition Frequency	300 Hz (Typical) 1200 Hz (Maximum)
Antenna	Patch 1 (IDPCA) Linear Array
Gain	5 dBi
Antenna Size	32 ft x 8 ft
Horizontal Beamwidth	7.5°
Vertical Beamwidth	30°
Sidelobe Gain at Antenna	-10 dBi
Backlobe Gain	-10 dBi
Minimum Elevation Angle of Operation (Fixed)	0°

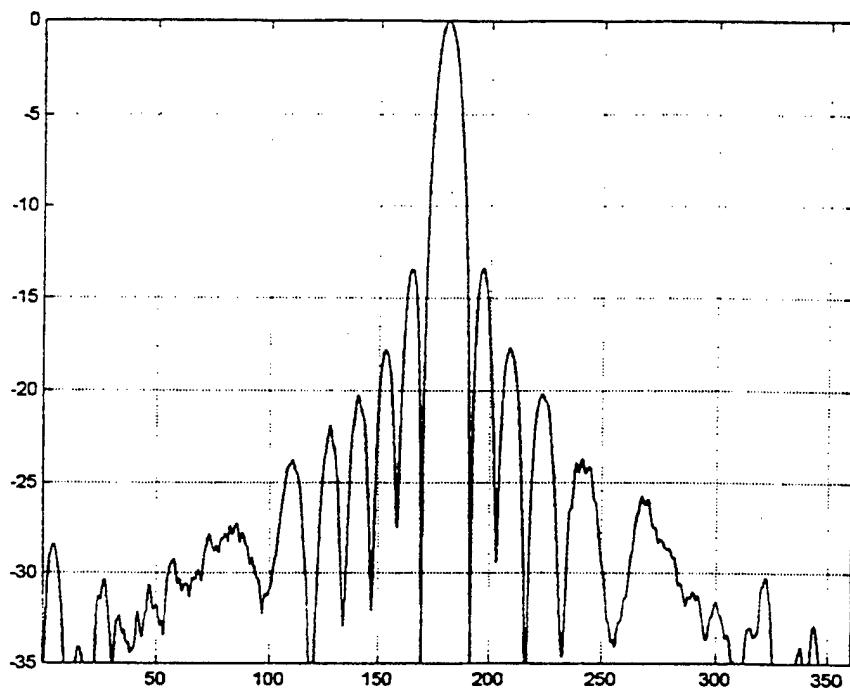


Figure 4. UESA Horizontal Antenna Pattern for RSTER Transmissions,
14 Active Elements, 9.7° Azimuth Beamwidth, 33° Elevation Beamwidth, 19.7 dBi

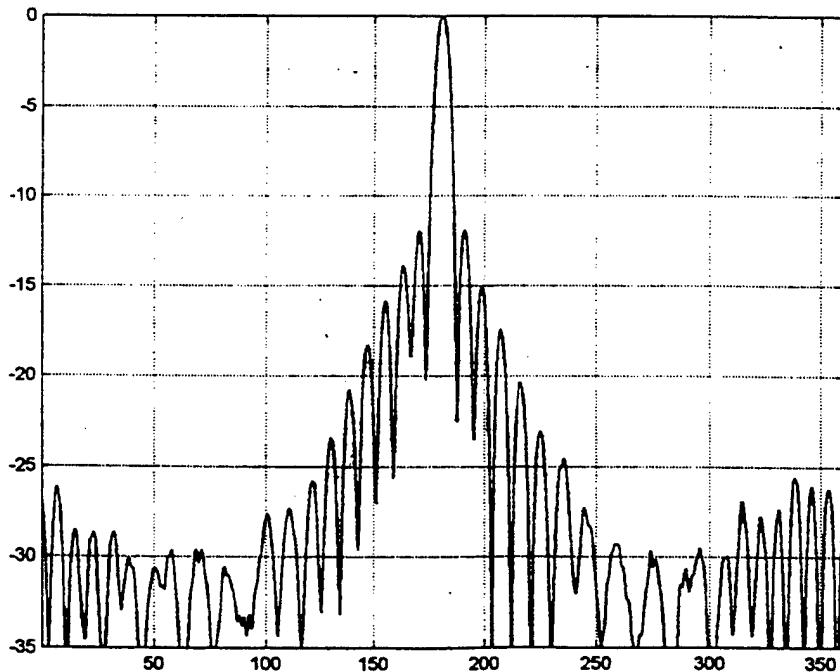


Figure 5. UESA Horizontal Antenna Pattern for MSSTIC Transmissions,
27 Active Elements, 6.4° Azimuth Beamwidth, 32° Elevation Beamwidth, 21.0 dBi

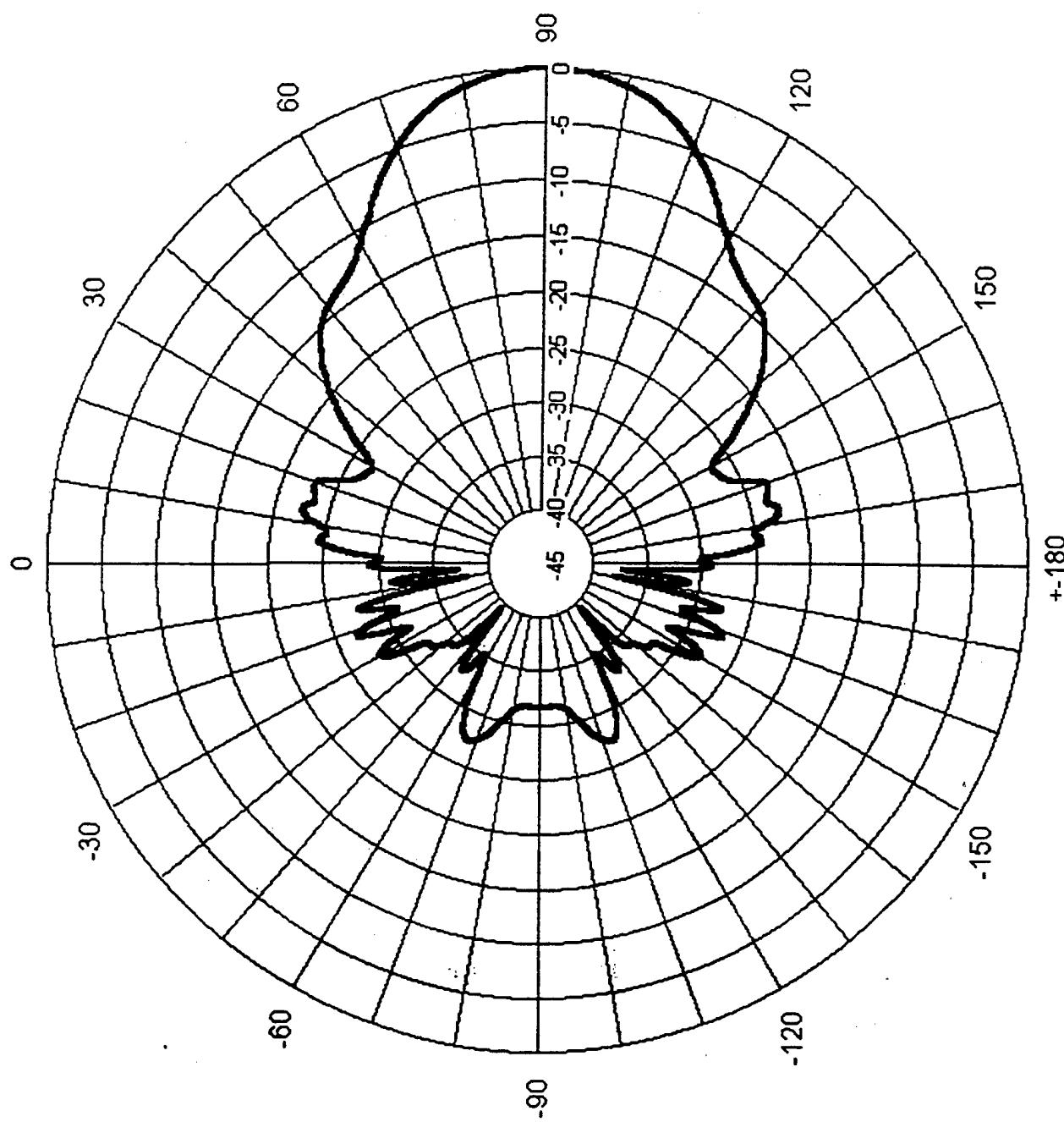


Figure 6. UESA Vertical Antenna Gain Pattern for the RSTER and MSSTIC Radar Transmissions

1. The DoDI 6055.11 includes a two-tier exposure criteria for controlled and uncontrolled environments. See Table 4 for the permissible exposure limits (PEL's) for each environment.

a. Controlled environments (CE) are defined as areas where exposure may be incurred by personnel who are aware of the potential for RF exposures as a concomitant of employment or duties, exposure of individuals who knowingly enter areas where higher RF levels can reasonably be anticipated to exist, and exposure that may occur incidental to transient passage through such areas. Typically, for military sites, controlled environments include all operational and work areas. At Parcel "A", the controlled environments area would be defined by its boundaries. The Makaha Ridge facility is considered a controlled environment.

b. Uncontrolled environments (UCE) are defined as public areas where individuals have no knowledge or control of their exposure. Such areas include living quarters, workplaces, or public areas where there are no expectations that higher RF levels should exist. On-base housing (BOQ's and BEQ's, and family living quarters) and associated facilities such as commissaries, exchanges, and recreational facilities are considered uncontrolled environments areas. None of the areas in this study would be considered an UCE.

c. Averaging Time: In HERP analysis, exposure is defined as the instantaneous average power density exposure averaged over the averaging time. The instantaneous average power density may exceed the PEL provided that the averaged exposure over any averaging period is equal to or below the corresponding PEL. Table 4 also lists the averaging times.

d. Scanning and Rotating Radar Beams: For exposures to a radar beam that is rotating (and/or scanning), time averaging can be applied since main beam exposure of any one point occurs for only a portion of the total sweep time.

2. FCC 96-326: As advised by Mr. Russell Takata of the SOH Department of Health, the SOH does not have a technical RF protection guide but would most likely adapt the FCC 96-326 as its guide. The FCC 96-326 is similar to the DoDI 6055.11 in that it also has a two-tier structure; one for occupational/controlled exposure (O/CE) and another for the general population/uncontrolled exposure (GP/UE). The maximum permissible exposure (MPE) limits and averaging times are shown on Table 4.

a. Ground: Exposure of all personnel not related to the PMRF mission beyond the PMRF station boundaries or perimeter fences will be evaluated according to the GP/UE MPE.

b. In Flight: Exposure of all personnel in civil aircraft and not related to the PMRF mission beyond the PMRF station boundaries or perimeter fences will be evaluated according to the O/CE MPE.

3. The following table lists the DoDI 6055.11 PEL's and FCC 96-326 MPE's for transmissions at 435 MHz, the frequency that the MSSTIC radars will normally operate at. As shown, the PEL's and MPE's are identical.

Table 4. DoDI 6055.11 PEL's and FCC 96-326 MPE's for 435 MHz

DoDI 6055.11 Controlled Environments		DoDI 6055.11 Uncontrolled Environments		FCC 96-326 Occupational/ Controlled Exposure		FCC 96-326 General Population/Uncontrolled Exposure	
PEL (mW/cm ²)	Averaging Time (Minutes)	PEL (mW/cm ²)	Averaging Time (Minutes)	MPE (mW/cm ²)	Averaging Time (Minutes)	MPE (mW/cm ²)	Averaging Time (Minutes)
1.45	6	0.29	30	1.45	6	0.29	30

Note: mW/cm² = milliwatts per square centimeter (average power density)

4. Prolonged Exposure: Both the DoDI 6055.11 and FCC 96-326 specify a averaging time of exposure as part of the electromagnetic field criteria. The averaging time should not be misconstrued as a maximum period of exposure. Exposures at or below the PEL or MPE are permitted for an indefinite period.

B. HERF: HERF is the ignition of fuel vapor by arcing. These fuels include AVGAS, MOGAS, and JP-4. Diesel and JP-5 fuel are not vulnerable to RF arcs due to their low vapor pressure at ordinary temperatures.

1. The hazards due to RF arcs is primarily related to the making and breaking of metal to metal contact. Typically, this occurs during the insertion and removal of fuel nozzles during refueling or defueling.

2. Shore Sites: The RF hazard energy levels are promulgated by NAVSEA OP 3565 Volume I Fifth revision, *Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel and Other Flammable Material)* dated 15 July 1982. For radars and other pulsed transmitters the HERF criteria is 5 watts/cm² (5,000 mW/cm²) peak power density.

C. ELECTRONIC EQUIPMENT RADIATED SUSCEPTIBILITY EMI: Electronic equipment and subsystems are susceptible to RF fields.

1. To avoid malfunction or performance degradation, DoD procured equipment should be built to MIL-STD-461D (*Requirements for the Control of Electromagnetic Interference Emission and Susceptibility* dated 11 January 1993) RS103 requirements.

a. Equipment meeting the MIL-STD-461D RS103 limit for ground electronic equipment should not experience EMI in the radiated electric (E)-fields of 10 V/m (peak) or less for frequencies between 10 kHz to 1 GHz.

b. Commercial Off-the-Shelf (COTS) Equipment: Although most COTS equipment are not tested for radiated susceptibility, EMI may occur in fields above 1 V/m at HF, VHF and UHF frequencies. The attenuation provided by the buildings these equipment are installed in is sufficient to consider their RS limit equal to 10 V/m.

c. Equipment meeting the MIL-STD-461D RS103 limit for external or safety critical aircraft electronic equipment should not experience EMI in the radiated E-fields of 200 V/m (peak) or less for frequencies between 10 kHz to 40 GHz.

2. FAA High Intensity Radiated Field (HIRF) Levels and Flight Restrictions:

a. NAWCAD Patuxent River Report NAWCADPAX-98-156-TM, *HIRF External Environments for Civil Aircraft Operating in the United States of America* of 12 November 1998, provided RF levels that the FAA should use to certify civil aircraft based on RF environments currently encountered. Four levels of RF environments were documented; Rotorcraft Severe, Fixed Wing Severe, Certification, and Normal, see Table 5. As advised by NAWCAD (Mr. M. Dalbulskis) the *Certification* levels recommended in the report should be used in determining the stand-off distances for civil aircraft since it would cover the wide variety of aircraft used in western Kauai.

Table 5. HIRF Levels Recommended to FAA for Frequencies Between 400 to 500 MHz

Environment	Rotocraft Severe		Fixed Wing Severe		Certification		Normal	
Frequency	Peak (V/m)	Avg. (V/m)	Peak (V/m)	Avg. (V/m)	Peak (V/m)	Avg. (V/m)	Peak (V/m)	Avg. (V/m)
400 to 700 MHz	402	402	80	80	40	40	40	40

Note: Avg. = Average

b. There are flight restrictions for commercial aircraft specified in the NOAA *Hawaiian Island Sectional Aeronautical Chart* (updated every 6 months), the Special Federal Aviation Regulation (SFAR)-71, and between the Kauai Tour Pilots Association and the FAA.

(1) The NOAA *Hawaiian Island Sectional Aeronautical* chart shows that the airspace up to 3 miles off the coast of western Kauai extending due north of 159° 42' 00" (Puanaiea Point) to Kekaha in the south is restricted (R3101) and controlled by PMRF (from 0600 to 1800 hours, Monday through Friday). The sectional aeronautical chart also show a navigational warning for areas within 2,500 feet of the Universal S-band (USB) antenna at the NASA KPGO due to electromagnetic radiation.

(2) SFAR-71 specifies a 1000 feet above ground level (AGL) minimum height flight requirement for fixed wing aircraft and a 1,500 feet horizontal or vertical clearance for helicopters. SFAR-71 will expire on October 2000 but will probably be extended for another two years.

(3) As advised during a discussion with Mr. David Ryan of the Honolulu Flight Standards Office, the FAA has also made agreements with the Kauai Tour Pilots Association to allow deviations from the SFAR-71. Aircraft are allowed to fly 500 feet AGL over ridges due

to potential low cloud cover. Helicopters are permitted to fly 500 feet AGL except over areas with buildings or any area with signs of human presence (cars, etc.). Routes have been established over which the tour aircraft will normally fly. These are shown on Figures 7 and 8. Pilots not participating in the agreement must abide by the SFAR-71.

D. EMR HAZARD ANALYSIS PROCEDURES: The RF powers at the antenna and antenna gain patterns in Tables 1 through 3 and Figures 4 through 6 were used to calculate separation distances using the free space transmission formula between the antennas and where their RF signals are equal to the previously cited criteria. See Appendix B for the free space transmission formula.

V. ELECTROMAGNETIC COMPATIBILITY ANALYSIS

A. During a meeting between PMRF (Mr. A. Soto) and SPAWARSYSACT PAC (Mr. S. Kobashigawa) on 2 June 1999, we were advised that the EMC study should be limited to 435 MHz, the frequency normally used in the MSITP and WAD Program testing. Use of additional frequencies will be preceded by another EMC study.

B. Co-channel and Adjacent Channel: The JFMO PAC *Enhanced Frequency Resource Record System* (EFRRS), National Telecommunications and Information Agency (NTIA) *Government Master File*, and the FCC *Northwest Region Master* frequency databases were searched to identify vulnerable systems operating within 60 miles of any proposed site.

C. Harmonic, Transmitter Spurious Emissions, Receiver Spurious Response and Intermodulation Product (IMP) EMI: Analysis for these types of EMI were usually limited to co-site located systems.

VI. EMR HAZARDS ANALYSIS RESULTS

A. MSSTIC at Parcel "A", NKTS: As noted earlier, only the RSTER transmitter will be used at the MSSTIC at Parcel "A" with the UESA antenna mounted on a tower structure such that its top will be 100 feet AGL. Table 6 lists the calculated HERP, HERF, RS103, and FAA HIRF *Certification* separation distances from the UESA antenna due to the RSTER transmissions.

1. HERP:

a. Main beam: Due to the height of the UESA antenna, normally accessible areas will not be exposed to main beam illumination.

b. Sidelobe:

(1) Within Parcel "A": The calculated HERP separation distance for CE (and the FCC O/CE) is 45 feet for angles greater than 30° from boresight (main beam axis). Due to the

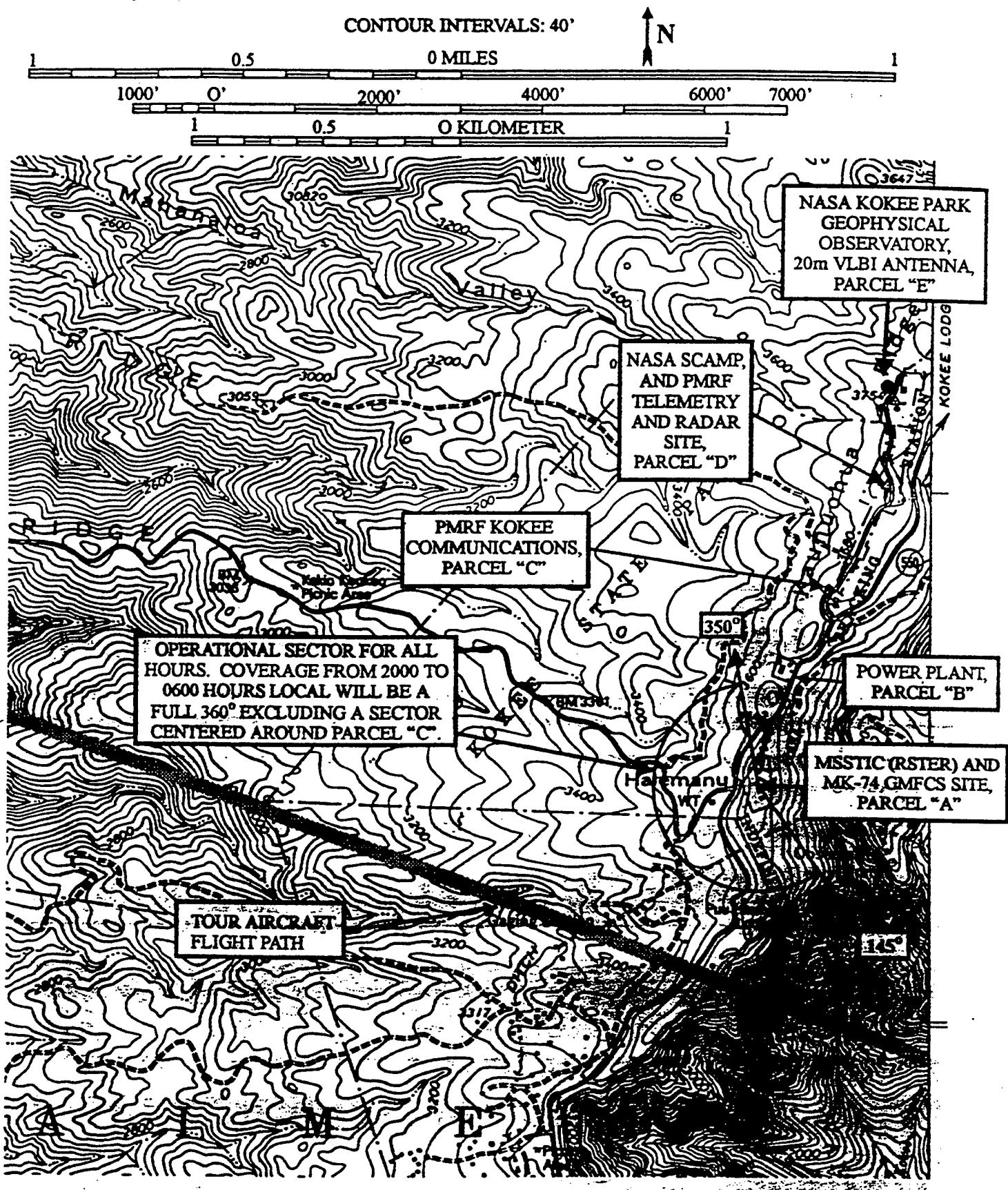


Figure 7. Topographic Map of the NASA Kokee Tracking Station and the Surrounding Area

CONTOUR INTERVALS: 40'

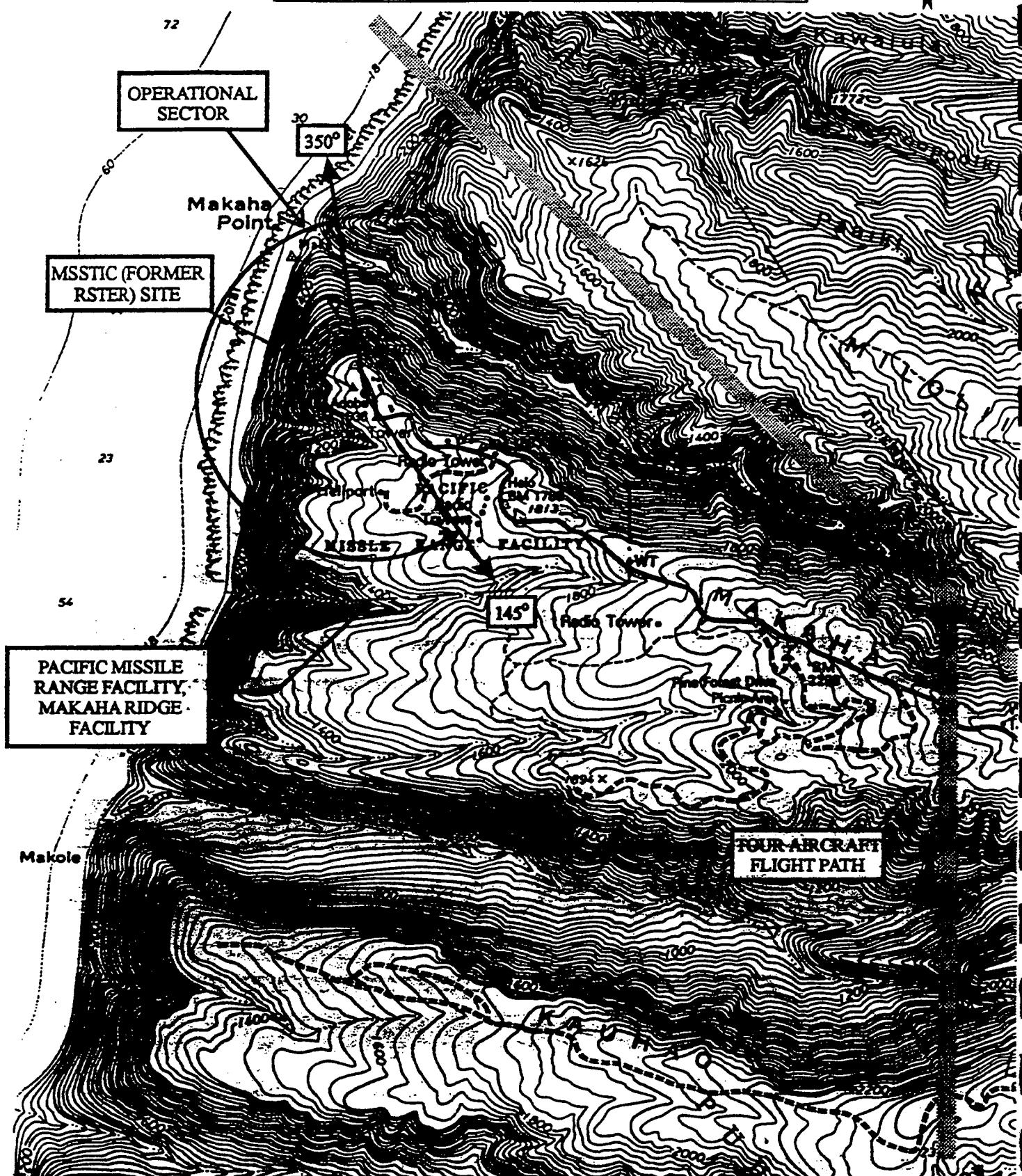
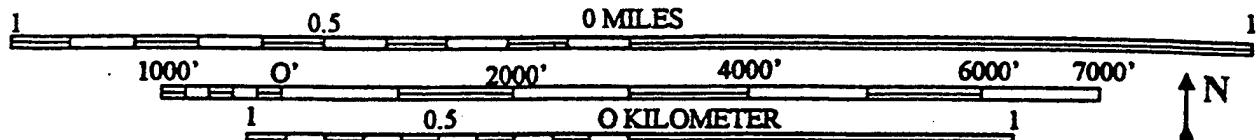


Figure 8. Topographic Map of PMRF's Makaha Ridge Facility and the Surrounding Area

RSTER TRANSMITTER AND UESA ANTENNA, 140 kW PEAK AT TRANSMITTER OUTPUT LESS SYSTEM LOSSES

CATEGORY	FREQUENCY (MHZ)	POWER (WATT)	GAIN (dBi)	CRITERIA		SEPARATION	
				(mW/cm ²)	(V/m)	(METER)	(FEET)
HERP, CONTROLLED ENVIRONMENTS (NOTE 1)	435	4,724	19.7	1.45	73.9	49	161
HERP, CONTROLLED ENVIRONMENTS, >9 DEG FM BS (HOR)	435	4,724	6.2	1.45	73.9	10	34
HERP, CONTROLLED ENVIRONMENTS, >30 DEG FM BS (ELE)	435	4,724	8.7	1.45	73.9	14	45
HERP, UNCONTROLLED ENVIRONMENTS (NOTE 2)	435	4,724	19.7	0.29	33.1	110	361
HERP, UNCONTROLLED ENVIRONMENTS, >9 DEG FM BS (HOR)	435	4,724	6.2	0.29	33.1	23	76
HERP, UNCONTROLLED ENVIRONMENTS, >30 DEG FM BS (ELE)	435	4,724	8.7	0.29	33.1	31	102
HERF	435	78,728	19.7	5000.0	4341.7	3	11
MIL-STD-461D RS-103, GROUND	435	78,728	19.7	0.027	10.0	1,485	4,871
MIL-STD-461D RS-103, GROUND, >30 DEG FM BS (ELE)	435	78,728	8.7	0.027	10.0	418	1,373
MIL-STD-461D RS-103, GROUND, >55 DEG FM BS (ELE)	435	78,728	-2.8	0.027	10.0	111	365
MIL-STD-461D RS-103, GROUND, BELOW ANTENNA (ELE)	435	78,728	-9.3	0.027	10.0	53	173
MIL-STD-461D RS-103, GROUND, >7.5 DEG FM BS (HOR)	435	78,728	12.2	0.027	10.0	628	2,054
MIL-STD-461D RS-103, GROUND, >9 DEG FM BS (HOR)	435	78,728	6.2	0.027	10.0	314	1,029
MIL-STD-461D RS-103, GROUND, >20 DEG FM BS (HOR)	435	78,728	1.7	0.027	10.0	187	613
MIL-STD-461D RS-103, AIRCRAFT EXTERNAL/SAFETY CRITICAL	435	78,728	19.7	10.6	200.0	74	244
FAA HIRF CERTIFICATION, PEAK	435	78,728	19.7	0.4	40.0	371	1,218
FAA HIRF CERTIFICATION, AVERAGE	435	4,724	19.7	0.4	40.0	91	298

MSSTIC TRANSMITTER AND UESA ANTENNA, 270 kW PEAK AT TRANSMITTER OUTPUT LESS SYSTEM LOSSES

CATEGORY	FREQUENCY (MHZ)	POWER (WATT)	GAIN (dBi)	CRITERIA		SEPARATION	
				(mW/cm ²)	(V/m)	(METER)	(FEET)
HERP, CONTROLLED ENVIRONMENTS (NOTE 1)	435	9,110	21	1.45	73.9	79	260
HERP, CONTROLLED ENVIRONMENTS, >30 DEG FM BS (ELE)	435	9,110	10	1.45	73.9	22	73
HERP, CONTROLLED ENVIRONMENTS, >55 DEG FM BS (ELE)	435	9,110	-1.5	1.45	73.9	6	20
HERP, UNCONTROLLED ENVIRONMENTS (NOTE 2)	435	9,110	21	0.29	33.1	177	582
HERP, UNCONTROLLED ENVIRONMENTS, >30 DEG FM BS (ELE)	435	9,110	10	0.29	33.1	50	164
HERF	435	151,832	21	5000.0	4341.7	6	18
MIL-STD-461D RS-103, GROUND	435	151,832	21	0.027	10.0	2,395	7,857
MIL-STD-461D RS-103, GROUND, >30 DEG FM BS (ELE)	435	151,832	10	0.027	10.0	675	2,214
MIL-STD-461D RS-103, GROUND, >55 DEG FM BS (ELE)	435	151,832	-1.5	0.027	10.0	180	589
MIL-STD-461D RS-103, GROUND, BELOW ANTENNA (ELE)	435	151,832	-8	0.027	10.0	85	279
MIL-STD-461D RS-103, GROUND, >12 DEG FM BS (HOR)	435	151,832	7	0.027	10.0	478	1,568
MIL-STD-461D RS-103, GROUND, >64 DEG FM BS (HOR)	435	151,832	-6	0.027	10.0	107	351
MIL-STD-461D RS-103, AIRCRAFT EXTERNAL/SAFETY CRITICAL	435	151,832	21	10.6	200.0	120	393
FAA HIRF CERTIFICATION, PEAK	435	151,832	21	0.4	40.0	599	1,964
FAA HIRF CERTIFICATION, AVERAGE	435	9,110	21	0.4	40.0	147	481

IDPCA SYSTEM (SDI586HI TRANSMITTER AND PATCH 1 ANTENNA) 600 W PEAK AT TRANSMITTER OUTPUT

CATEGORY	FREQUENCY (MHZ)	POWER (WATT)	GAIN (dBi)	CRITERIA		SEPARATION	
				(mW/cm ²)	(V/m)	(METER)	(FEET)
HERP, CONTROLLED ENVIRONMENTS (NOTE 1)	435	37.5	5	1.45	73.9	1	3
HERP, UNCONTROLLED ENVIRONMENTS (NOTE 2)	435	37.5	5	0.29	33.1	-2	6
HERF	435	600	5	5000.0	4341.7	0	0
MIL-STD-461D RS-103, GROUND	435	600	5	0.027	10.0	24	78
MIL-STD-461D RS-103, GROUND, BACKLOBE AND SIDELOBE	435	600	-10	0.027	10.0	4	14
MIL-STD-461D RS-103, AIRCRAFT EXTERNAL/SAFETY CRITICAL	435	600	5	10.6	200.0	1	4
FAA HIRF CERTIFICATION, PEAK	435	600	5	0.4	40.0	6	20
FAA HIRF CERTIFICATION, AVERAGE	435	37.5	5	0.4	40.0	1	5

NOTE 1. The criteria for the DoDI 6055.11 Controlled Environments and the FCC Occupational/Controlled Exposure are identical.

NOTE 2. The criteria for the DoDI 6055.11 Uncontrolled Environments and the FCC General Population/Uncontrolled Exposure are identical.

Legend: HERP and HERF: Hazards of Electromagnetic Radiation to Personnel and Fuel. RS = Radiated Susceptibility

> 9 DEG FM BS = Greater Than 9 Degrees from Boresight (Main Beam Axis), ELE = Elevation, HOR = Horizontal, HIRF = High Intensity Radiated Field

Table 6. Calculated HERP and HERF, MIL-STD-461D RS103, and FAA HIRF Separation Distances for the RSTER, MSSTIC Radar, and IDPCA

height of the tower (100 feet AGL), employees within Parcel "A" will be beyond the area in which the CE PEL will be exceeded.

(2) Beyond Parcel "A": Figure 9 shows the zone in which the GP/UE MPE will be exceeded, based on the UESA elevation antenna pattern, projected on to the ground elevation profiles at azimuths of 350° , 315° , 270° , 235° , and 180° at Parcel "A". As can be seen the zones are above any area accessible to the general public in Kokee Park.

(3) Impact to Aircraft: As shown on Figure 9, the zone in which the GP/UE MPE will be exceeded does not extend above the minimum fixed wing aircraft height of 500 feet AGL for ridge crossings. Helicopters must maintain a vertical or horizontal separation distance of 1,500 feet from ground structures.

2. HERF: The calculated HERF separation distance for main beam exposure is 11 feet. The closest fuel storage site is at the back-up generator plant at Parcel "B" which is 1,400 away.

3. Radiated Susceptibility:

a. MIL-STD-461D Ground Electronic Equipment:

(1) Unrestricted (145° to 350° Azimuth): The calculated RS-103 separation distance for ground electronic equipment is 1,029 feet for exposures beyond 9° from boresight in the horizontal plane (a site at the same elevation as the UESA antenna). The closest site aside from the electronic equipment housed immediately below the antenna is the back-up generator plant about 1,400 feet away and at approximately 17° from boresight when the UESA antenna is pointed at 350° . The sites at Parcels "C", "D", and "E" are at least 25° away, see Figure 7.

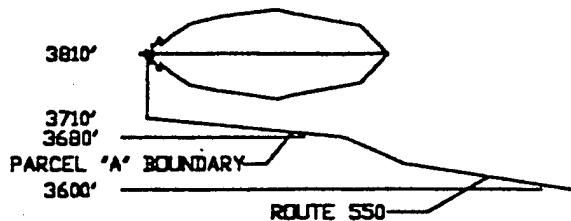
(2) Between 2000 and 0600 Hours Local Time: Between these hours, the operation range will be expanded to a full 360° azimuth less a 15° sector centered at Parcel "C". Parcels "C", "D", and "E" will all lie just at 7.5° from boresight of the UESA antenna. The calculated RS-103 separation distance for angles beyond 7.5° from boresight is 2,054 feet. All parcels (except Parcel "B") will be beyond the calculated RS103 separation distance.

(3) The equipment within Buildings 775 and 777, directly below the UESA antenna are within the calculated RS103 separation distance of 173 feet. However, no RS103 EMI were experienced during prior tests with the RSTER and ADS-18S antenna. The vertical radiation patterns for the ADS-18S and the UESA antennas are similar.

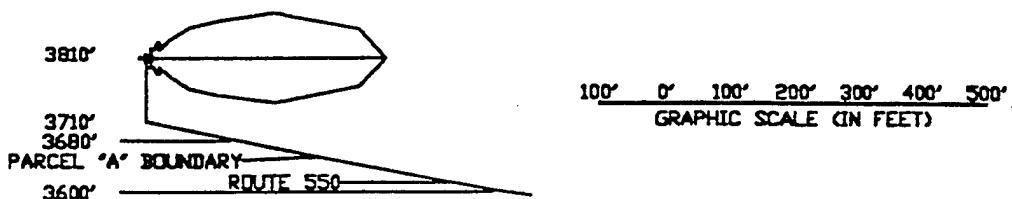
b. MIL STD-461D External or Safety Critical Electronic Equipment: The calculated RS103 separation distance for DoD aircraft meeting the MIL-STD-461D criteria is 244 feet. It is not anticipated that aircraft will fly within 244 feet of the UESA antenna.

c. Civil Aircraft: The calculated FAA HIRF *Certification* separation distance is 1,218 feet for main beam exposure. Based on the UESA elevation antenna pattern, the highest point above the UESA antenna that the FAA HIRF *Certification* level will be exceeded is 336

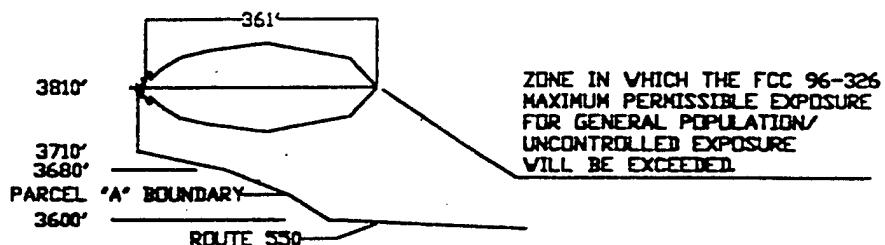
ELEVATION PROFILE FOR 350° AZIMUTH, 0° ELEVATION ANGLE



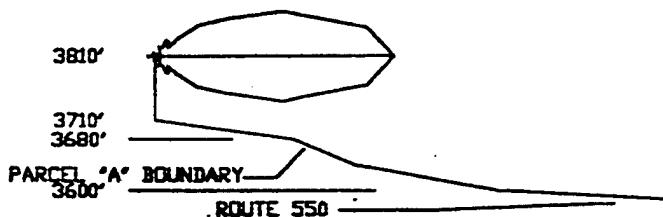
ELEVATION PROFILE FOR 315° AZIMUTH, 0° ELEVATION ANGLE



ELEVATION PROFILE FOR 270° AZIMUTH, 0° ELEVATION ANGLE



ELEVATION PROFILE FOR 225° AZIMUTH, 0° ELEVATION ANGLE



ELEVATION PROFILE FOR 180° AZIMUTH, 0° ELEVATION ANGLE

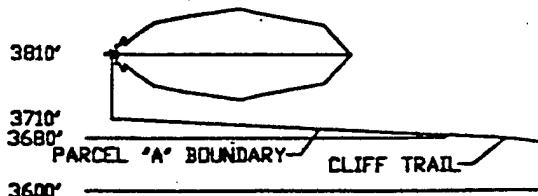


Figure 9. Sketch Showing the Projection of the Maximum Permissible Exposure (MPE) Zone for General Population/Uncontrolled Exposure from the RSTER Transmissions at Parcel "A", NKTS

feet AGL and below the minimum flight altitude. Since fixed wing aircraft must clear the ridges by 500 feet, it is anticipated that they will be above the main beam within 1,218 feet of the antenna. Helicopters must maintain a 1,500 feet vertical or horizontal clearance from any ground structure and thus should be beyond 1,218 feet of the UESA antenna. As shown on Figure 7, the path normally used by tour aircraft is well beyond 1,218 feet of the UESA antenna.

B. MSSTIC PMRF-Makaha Ridge: As cited earlier, the MSSTIC radar (currently in development) will be used at Makaha Ridge along with the UESA antenna. The UESA antenna will be mounted on the existing tower structure built for the MSITP such that its top will be 85 feet AGL. The IDPCA system that is already installed at Makaha Ridge will be part of the MSSTIC. Table 6 lists the calculated HERP, HERF, RS103, and FAA HIRF *Certification* separation distances from the UESA antenna due to the MSSTIC transmissions and for the IDPCA system. No discussion pertaining to the EMR hazards of the IDPCA system is included since the calculated separation distances shown on Table 6 shows its EMR is of minimal hazard.

1. HERP:

a. Main beam: The calculated HERP separation distance for CE (and the FCC O/CE) is 260 feet for main beam illumination. Due to the height of the antenna and sector blanking, normally accessible areas will not be exposed to main beam illumination. As shown on Figure 2, the AN/FPQ-10 tracking radar platforms on Building 712 and 714 are within the calculated HERP separation distance and are high enough to be in the UESA antenna main beam. However, no HERP is predicted since the platforms are in the blanked sector.

b. Sidelobe:

(1) At Ground Level: The zone in which the CE PEL will be exceeded, based on the UESA elevation antenna pattern, projected on the elevation profile of the surrounding terrain at 350° azimuth is shown on Figure 10. All structures including Building 770 (the electronic warfare (EW) building) are beyond the zone. As noted on the figure, Building 770 lies at 0° azimuth but is included for illustrative purposes.

(3) Impact to Aircraft: As shown on Figure 2, the helo pad is well beyond the calculated HERP separation distance for controlled environments of 260 feet. Helicopters landing on the helo pad have been advised to approach the pad from the southeast and below the AN/SPS-48E 5° wide (vertically) beam which starts at 29° elevation angle. This practice will keep the in flight helicopters beyond the calculated HERP separation distance. Civil fixed wing aircraft and helicopters must maintain an altitude of 1,000 and 1,500 feet, respectively, above PMRF-Makaha Ridge. These altitudes are above the highest point (140 feet AGL) of the zone in which the O/CE MPE (identical to the CE PEL) will be exceeded, see Figure 10.

2. HERF: The calculated HERF separation distance for main beam illumination is 18 feet. The closest fuel storage site is the above ground, MOGAS tank and dispenser located 115 feet away from the base of the antenna tower. It is beyond the calculated HERF separation distance and will not be subjected to main beam illumination.

ZONE IN WHICH THE DoD 6055.11
PERMISSIBLE EXPOSURE LIMIT
FOR CONTROLLED ENVIRONMENTS
WILL BE EXCEEDED.

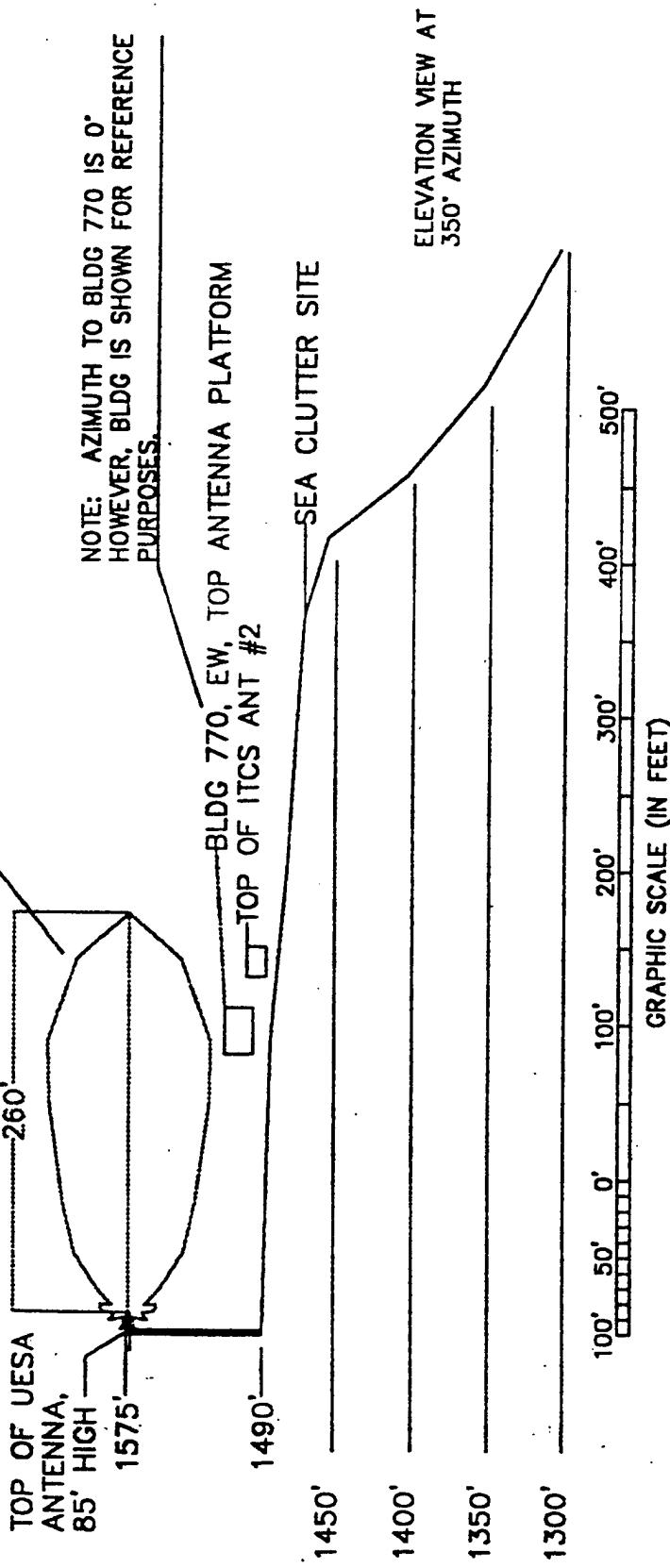


Figure 10. Sketch Showing the Projection of the Permissible Exposure Limit (PEL) Zone for Controlled Environments from the MSSTIC Radar Transmissions at PMRF-Makaha Ridge

3. Radiated Susceptibility:

a. MIL-STD-461D Ground Electronic Equipment: The calculated RS-103 separation distance for ground electronic equipment is 279 feet for exposures immediately below the main beam of the antenna.

(1) During prior tests with the RSTER transmitter and ADS-18S antenna, electronic equipment in Building 770 (EW) and Building 715 (AN/SPS-48E and AN/APS-134) experienced severe RS EMI when the ADS-18S was pointed at 0° azimuth (directly over the buildings, see Figure 2). No RS EMI were visible when the ADS-18S antenna was pointed at 350° azimuth. Due to sector blanking, no RS103 EMI has been reported in electronic equipment in the other buildings surrounding the RSTER site.

(2) No RS EMI has been experienced during past RSTER transmissions with the ADS-18S antenna pointed from 150° to 315° azimuth.

(3) No RS EMI has been visible in the electronic equipment located in the RSTER equipment vans located directly below the ADS-18S antenna.

b. MIL-STD-461D External or Safety Critical Aircraft Electronic Equipment: The calculated RS103 separation distance for external or safety critical aircraft electronic equipment is 393 feet and well within the distance to the helo pad of 1,250 feet. As noted earlier the recommended southeast approach to the helo pad will not place the helicopters any closer to the UESA antenna.

c. Civil Aircraft: The calculated FAA HIRF *Certification* separation distance is 1,964 feet for main beam exposure. Since fixed wing aircraft and helicopters must maintain heights of 1,000 and 1,500 feet AGL, respectively, over PMRF-Makaha Ridge, it is anticipated that they will be above the main beam within 1,964 feet of the antenna. Based on the UESA elevation antenna pattern, the highest point above the UESA antenna that the FAA HIRF *Certification* level will be exceeded is 463 feet and below the minimum flight altitudes. Figure 8 shows that the normal path used by tour aircraft is well beyond the calculated FAA HIRF *Certification* separation distance from the UESA antenna.

VII. EMC ANALYSIS RESULTS:

A. Co-channel and Adjacent Channel Interference:

1. The RSTER program has an experimental frequency assignment in the FRRS system from 420 to 450 MHz, a frequency range with many other frequency assignments. As noted earlier, radar transmissions from the MSSTIC sites at the NKTS and PMRF-Makaha Ridge will be limited to 435 MHz (used during prior MSITP and WAD testing at Parcel "A" and Makaha Ridge). If additional frequencies are required, an additional EMC study will be done to ensure that no EMI will occur to existing RF systems.

2. Adjacent channel interference is predicted for the Command Guidance and Command Destruct (CG&CD) frequency of 437 MHz. The CG&CD transmissions are made from either the Department of Energy (DOE) Kauai Test Facility (KTF) at Barking Sands run by Sandia Laboratory or PMRF's Kokee Communications site at Parcel "C", NKTS.

a. The CG&CD signals are transmitted from the helical antennas at KTF or the omni and helical antennas on PMRF's Kokee microwave tower. The signals are used to control rockets and missiles launched from the launch pads at Barking Sands. If the launched vehicle fails to receive the CG&CD signal for a few seconds, the vehicle's self destruct sequence will be initiated.

b. The RSTER has a transmission bandwidth of 2.8 MHz and the current maximum bandwidth of the CG&CD signal is 300 kHz. However, future CG&CD packages may have maximum bandwidths of 600 kHz to 3 MHz.

B. Harmonic EMI: See Table 7 for a list of the harmonics.

Table 7. Harmonics of the MSSTIC 435 MHz Transmissions.

2ND (MHz)	3RD (MHz)	4TH (MHz)	5TH (MHz)	6TH (MHz)	7TH (MHz)
870	1305	1740	2175	2610	3045

1. The second harmonic falls within the 869 to 894 MHz frequency range used by Ameritech Cellular Services systems at PMRF-Barking Sands and PMRF-Makaha Ridge to provide cellular phone service in those areas. No harmonic EMI to the cellular phone service has been reported due to past RSTER operations at Makaha Ridge. However, the MSSTIC radar's second harmonic emissions will be significantly higher than the RSTER's, -30 dB referenced to the carrier level (dBc) verses -80 dBc. Since the MSSTIC's transmissions at PMRF-Makaha Ridge will be primarily seaward, the impact of second harmonic EMI on the cellular service will be minimal. A cellular site may be installed on the PMRF microwave tower at Parcel "C", NKTS. Based on past operations at Makaha Ridge, no second harmonic EMI is predicted due to the RSTER operations at NKTS.

2. The third harmonic falls within the frequency range of the HIANG AN/FPS-117 ASR at the KAFS. The MSSTIC transmissions from either site will be sector blanked in the direction of KAFS. There is no line-of-sight path between the MSSTIC site at Makaha Ridge and the KAFS. No harmonic EMI has been experienced during past RSTER operations.

3. The fourth harmonic falls on a frequency formerly used to relay video signals from Makaha Ridge to Barking Sands. The video signals are now transported via an 18 GHz microwave link and the 1,740 MHz link is no longer in use.

4. The fifth harmonic falls into the 2,100 to 2,400 MHz S-band cited in USNO letter 3160 Serial S/091 of 2 February 1990 which cites that EMI falling within that band should be below -130 dBwatt per square meter (dBW/m² or -100 dBm/m²) at the VLBI antenna.

Assuming a -80 dBc fifth harmonic emission and a -30 dBi net antenna gain (due to frequency and misalignment reductions), the calculated RSTER fifth harmonic power density at the VLBI antenna will be -113 dBm/m² and below the USNO EMI specification. The VLBI S-band frequencies of interest fall within the 2,200 to 2,400 MHz range, see Appendix A. The VLBI receiving system did not experience harmonic EMI during prior RSTER operations at Parcel "A", NKTS.

5. The seventh harmonic falls within the AN/SPS-48E (Building 717, antenna tower) frequency band of 2,900 to 3,100 MHz. The AN/SPS-48E has not experience harmonic EMI during prior RSTER operations at PMRF-Makaha Ridge including the period when the ADS-18S was pointed directly over the AN/SPS-48E antenna.

6. None of the harmonics fall on any frequency in use by systems operated by NASA at Parcels "D" and "E".

C. Transmitter Spurious Emission:

1. There are numerous CG&CD frequencies used in the 400 to 450 MHz range. The calculated power density at a point 5 miles off the coast of Makaha Ridge from the MSSTIC radar transmissions at PMRF-Makaha Ridge and NKTS, and the CG&CD destruct transmitters at NKTS are listed below. The calculations were made assuming -80 dBc transmitter spurious emissions from the MSSTIC radar and RSTER.

Table 8. Calculated Power Densities at a Launched Vehicle 8 Miles Off Shore of Makaha Ridge

MSSTIC Radar at Makaha Ridge	RSTER at NKTS	CG&CD Omni- Directional Antenna	CG&CD Helical Antenna
-70.8 dBm/m ²	-77.1 dBm/m ²	-39.1 dBm/m ²	-33.1 dBm/m ²

Based on the minimum calculated signal to interference (S/I) ratio of 31.7 dB, the transmissions from the MSSTIC radars should not interfere with the CG&CD signal reception. However, prior test have shown that partial terrain blockage exists between the Kokée microwave tower on which the CG&CD antennas are mounted and the vehicle launch pads and during portions of the vehicle flight path. In these instances, the S/I ratio may fall below the minimum recommended S/I ratio of 25 dB for digital data.

2. The findings of a prior EMC study for the MSITP forwarded by Naval Command, Control and Ocean Surveillance Center In-Service Engineering (ISE) West Activity letter 2000 Serial 322SK/50 of 21 January 1993 did not predict any transmitter spurious EMI to the UHF communication radios in the 200 to 400 MHz band. No EMI were experienced during past RSTER operations at Parcel "A", NKTS and PMRF-Makaha Ridge during the MSITP and WAD testing. Similarly, no transmitter spurious EMI to the UHF communication radios are predicted due to the MSSTIC radar transmissions.

D. Receiver Spurious Response: The findings of a prior EMC study for the MSITP forwarded by Naval Command, Control and Ocean Surveillance Center ISE West Activity letter 2000 Serial 322SK/447 of 17 June 1994 did not predict any receiver spurious response EMI to the SOH VHF repeater system at Kokee Park. No EMI were experienced by any VHF radio at NKTS or PMRF-Makaha Ridge during past RSTER operations during the MSITP and WAD testing. Similarly, no receiver spurious response EMI to the SOH VHF repeater system, the USCG VHF Maritime NDS, and the NOAA Weather Radio radios are predicted due to the MSSTIC radar transmissions.

E. Intermodulation Product (IMP) EMI: The RSTER has been previously operated with the ADS-18S antenna at Parcel "A", NKTS, and PMRF-Makaha Ridge with no reports of IMP EMI. The new MSSTIC radar's (at PMRF-Makaha Ridge) output will not be significantly higher (2.34 dB) than that of the RSTER and should not create any IMP EMI.

F. MK-74 Guided Missile Fire Control System (GMFCS): A MK-74 GMFCS which consists of an C-band tracking radar and an X-band illuminator has been recently installed at Parcel "A" in support of the U.S. Navy's Theater Ballistic Missile Defense (TBMD) and DoD Theater Missile Defense (TMD) exercises. The MK-74 uses a dual purpose antenna mounted on the existing 30 foot tower in front of Building 775. Due to the C-band and X-band waveguide cutoff frequencies of 4.29 and 5.26 GHz, respectively, no EMI is predicted to the C-band radar or X-band illuminator reception. Since the edge of the MK-74 operating sector is 0° azimuth, the UESA antenna installation will not impact the look angle of the MK-74 antenna.

G. Impact to the VLBI 20 Meter Antenna Look Angle: The top of the UESA antenna at Parcel "A" will be 3,810 feet above mean sea level (AMSL). The center of the VLBI 20 meter antenna is approximately 3,800 feet AMSL. Since the minimum look angle of the VLBI is +5°, the axis of the VLBI antenna will be 4,246 feet AMSL above Parcel "A" and well above the UESA antenna. The previous ADS-18S antenna installation at a similar height above Parcel "A" did not have any impact to the VLBI 20 meter antenna look angle.

VIII. CONCLUSIONS AND RECOMMENDATIONS

A. EMR Hazards:

1. HERP: Due to the height of the antennas and sector blanking, no HERP is predicted at either MSSTIC sites. To preclude an over exposure incident, the following actions are recommended for both sites:

a. Install the conventional PMRF blue warning light at the MSSTIC sites (the Makaha Ridge site is already equipped with the lights). A sign should be posted advising that and the blue light indicates that the RF transmissions are occurring. The conventional red light which indicates that the antenna drive is activated and the antenna may move at any time should not be required since the UESA antenna should not physically rotate.

- b. Install "BEYOND THIS POINT" RF warning signs shown on Figure 11. The signs should be posted on the base of the ladder to the UESA antenna tower and at the base of the IDPAC antenna.
- c. Secure the transmitter of any MSSTIC transmitting system prior to working on the RF cables or antennas.
- d. High Work Near the UESA Antenna: The RSTER or MSSTIC radar feeding the antenna should be silenced if high work that may result in main beam exposure is done within the calculated CE HERP separation distances listed on Table 6.

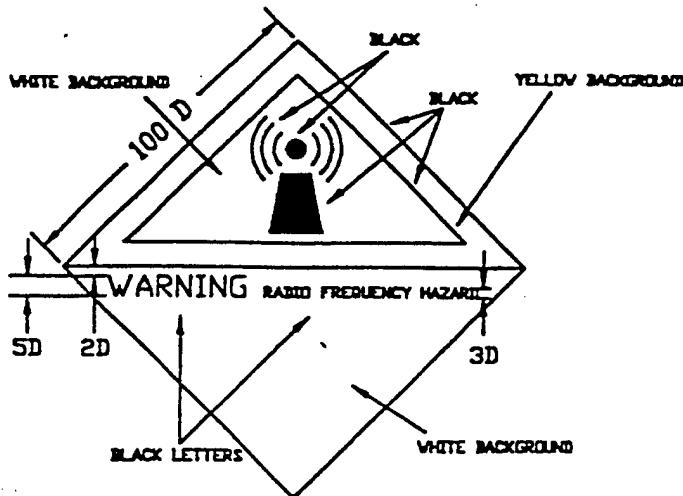
2. HERF: No HERF is predicted.

3. Radiated Susceptibility EMI:

- a. At Parcel "A", NKTS: Between 2000 and 0600 hours local time, the operation range will be expanded from 145° to 350° , to a full 360° azimuth less a 15° sector centered at Parcel "C". Parcel "B" will be within the calculated RS103 separation distance. It is recommended that the proposed sector blanked zone of 15° be widened and specifically defined as the sector $\pm 20^\circ$ from a line between the UESA antenna to the VLBI 20 meter dish at Parcel "E". This will place Parcel "B" beyond the calculated RS103 separation distance. The widening will further lower the possibility of EMI for electronic systems in Parcels "C", "D", and "E".
- b. At PMRF-Makaha Ridge: Buildings 770 (EW) and Building 715 (AN/SPS-48E) are within the calculated RS103 separation distance. Based on the results of prior RSTER RS testing, the MSSTIC transmissions may cause mission degrading RS EMI in electronic equipment in Building 770 and Building 715 if the levels are high enough. Prior testing with the RSTER has also shown that with the ADS-18S pointed at 350° or further southwestward (as planned for the MSSTIC) no RS EMI could be observed. It is recommended that RS testing be conducted after the installation of the MSSTIC radar and UESA antenna at PMRF-Makaha Ridge at 350° azimuth to ensure that no RS EMI does occur. Should RS EMI occur, the EMI may be eliminated by reducing the northmost operating azimuth or reducing the MSSTIC radar's output power.

B. EMC

- 1. Adjacent Channel Interference: Adjacent channel interference with the 437 MHz CG&CD reception is predicted. If concurrent operations with the MSSTIC radars and vehicle launches using the 437 MHz CG&CD frequency are planned it is recommended that compatibility tests be conducted prior to launch to ensure interference free operations.
- 2. Harmonic EMI: Although second and seventh harmonic EMI are predicted for the Ameritech Cellular Services cellular coverage and the AN/SPS-48E reception, respectively, none have occurred during past operations with the RSTER and ADS-18S. Harmonic EMI is not anticipated based on past operations.



Sign Title: RADIO FREQ HAZ WARNING-BLANK/SPEC COND/5"

NSN: 7890-01-377-5374

Sign Title: RADIO FREQ HAZ WARNING-BLANK/SPEC COND/12"

NSN: 7890-01-377-5375



'KEEP MOVING' sign



'BEYOND THIS POINT' sign



'RF BURN' sign



'FUELING OPERATIONS' sign

Sign Title: RADIO FREQ HAZ WARNING-KEEP MOVING PERSONNEL/5"

NSN: 7890-01-377-5893

Sign Title: RADIO FREQ HAZ WARNING-KEEP MOVING PERSONNEL/12"

NSN: 7890-01-377-5894

Sign Title: RADIO FREQ HAZ WARNING-BEYOND THIS POINT/5"

NSN: 7890-01-377-5895

Sign Title: RADIO FREQ HAZ WARNING-BEYOND THIS POINT/12"

NSN: 7890-01-377-5892

Sign Title: RADIO FREQ HAZ WARNING-BURN HAZARD/5"

NSN: 7890-01-377-5896

Sign Title: RADIO FREQ HAZ WARNING-BURN HAZARD/12"

NSN: 7890-01-377-5898

Sign Title: RADIO FREQ HAZ WARNING-FUEL OPNS/5"

NSN: 7890-01-377-5899

Sign Title: RADIO FREQ HAZ WARNING-FUEL OPNS/12"

NSN: 7890-01-377-5900

NOTE: SIGNS ARE MADE OF THIN AND FLEXIBLE PLASTIC SHEETS. RIGID BACKING REQUIRED.

Figure 11. Sample RF Radiation Hazard Warning Signs

3. Transmitter Spurious Emission EMI: The calculated S/I ratio for CG&CD signal reception on a launched vehicle is predicted to be above the minimum recommended S/I ratio for digital signal reception. However, since partial terrain blockage may exist between the CG&CD antennas on the Kokee microwave tower and the launched vehicle, the S/I ratio may fall below the recommended ratio. As cited earlier, if concurrent operations with the MSSTIC radars and vehicle launches using CG&CD frequencies are planned, it is recommended that compatibility tests be conducted prior to launch to ensure that the MSSTIC radar transmissions do not interfere with the vehicle's CG&CD reception (these tests may have already been conducted during the MSITP and WAD Program testing). No transmitter spurious emission EMI are predicted for the UHF communications radios in 200 to 400 MHz band.

4. Receiver Spurious Response and Intermodulation Product EMI: Based on the past EMC studies and the compatible operations of the RSTER and ADS-18S at Parcel "A", NKTS and at PMRF-Makaha Ridge, no receiver spurious response and intermodulation product EMI is predicted for existing VHF and UHF radios due to the proposed operations of the RSTER and MSSTIC radar with the UESA antenna. These radios include those used by the SOH VHF repeater system, the USCG VHF Maritime NDS, and NOAA Weather Radio.

5. No EMI is predicted to the reception of the MK-74 GMFCS recently installed at Parcel "A" in support of the U.S. Navy's TBMD and DoD TMD exercises. The UESA antenna installation at Parcel "A" will not impact the look angle of the MK-74 antenna.

C. Impact to the VLBI 20 Meter Antenna Look Angles: The top of the UESA antenna at Parcel "A" will be 436 feet below the center line axis of the VLBI antenna at the minimum +5° elevation angle of the VLBI antenna and will not impact its look angle.

D. VLBI Cooperative Scheduling: Although the study does not predict any adverse impact to VLBI reception from the MSSTIC planned for the NKTS, should EMI occur, it is recommended that the RSTER be silenced until the EMI problem can be eliminated. If no solution can be found, then it is recommended that operations of the RSTER be scheduled around VLBI operations. Local coordination can be done with Mr. Clyde Cox, the KPGO site manager at (808)335-6945 (commercial) or at a national level with Mr. William T. Wildes, the NASA VLBI Network Manager at (301)286-3332.

E. As with prior MSITP tests, it is recommended that all MSSTIC testing be coordinated through PMRF's Instrumentation Control Center (ICC) in Range Operations.

F. EMR Hazards and EMI Survey: It is recommended that a EMR hazards and EMI survey be conducted after the installation of the MSSTIC's at the NKTS and PMRF-Makaha Ridge. SPAWARSYSACT PAC is available to conduct the EMR hazards and EMI surveys.

APPENDIX A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) SYSTEMS AT THE NASA KOKEE TRACKING STATION (NKTS), KAUAI:

A. All NASA and National Oceanic and Atmospheric Administration (NOAA) systems (except for three) and the U.S. Naval Observatory (USNO) Very Long Baseline Interferometry (VLBI) system are located at Kokee Park Geophysical Observatory (KPGO) which is also known as Parcel "E" at the NKTS. The equipment are housed in the Unified S-band (USB) Building (Building 786) and the antennas are located throughout Parcel "E". The three exceptions are the VHF uplink for the Pan-Pacific Educational and Communications Experiments by Satellite (PEACESAT) Project, the DORIS Beacon and the Precise Range and Range-rate Experiment (PRARE). All three are located in the adjacent Parcel "D".

B. PEACESAT Project: PEACESAT uses the NOAA GOES-2 geostationary weather satellite to provide low cost communications to the islands of the Pacific. The primary VHF telemetry uplink is at 148.56 MHz and the downlink is at 136.38 MHz. A "small" terminal using 2031.30 to 2031.95 MHz uplinks and 1689.25 to 1689.95 MHz downlinks provide fifteen communications channels separated by 50 kHz. A 1694 MHz downlink serves as the backup telemetry signal. A S-band 6 meter antenna may be installed in the KPGO area to communicate with GOES-2 and -7.

1. The VHF uplink uses the Spacecraft Antenna on Medium Pedestal (SCAMP) antenna and a transmitter in Building 785 in Parcel "D". The VHF downlink uses the Spacecraft Automatic Tracking Antenna (SATAN) yagi antenna mounted on a tower behind the USB Building.

2. The S-band terminal uses a 3 meter dish mounted at ground level in front of the USB Building. The dish is pointed at 55° elevation and 220° azimuth. The downlink signal level is -121.8 dBm. The noise threshold is -128 dBm for the 15 kHz bandwidth receiver.

C. DORIS Beacon: The DORIS beacon installation is part of a worldwide network which provides precision orbit determinations for low orbit satellites equipped with the DORIS onboard package. The DORIS beacon consists of 401.25 MHz and 2036.25 MHz signals directed to the zenith (directly overhead) by a righthand-circular polarized, double-dipole antenna. The 401.25 MHz signal is transmitted at 5 watts and the 2036.25 MHz signal is transmitted at 10 watts. There are no receivers associated with the DORIS beacon at the NKTS.

D. PRARE: The PRARE system is installed in the SCAMP Building and uses a 60 centimeter offset antenna with a S- and X-band feed mounted on the roof of the building. The antenna requires a 360° azimuth and +5° to 90° elevation visibility. The PRARE communicates with low earth satellites belonging to the European Space Agency. The uplink frequency is 7.225 GHz and the downlink frequencies are 2.248 and 8.489 GHz. The S- and X-band downlink frequencies require ±50 and ±100 MHz signal free bands, respectively.

E. Global Positioning System (GPS): The GPS is a ground positioning system using transmissions from the NAVSTAR satellites. The downlink frequencies are 1227.60 (L1) and 1575.42 (L2) MHz. There are two GPS receiving systems at KPGO. One system, used to

provide timing for the NASA and VLBI systems, receives the L1 signal via the GPS antenna on the roof of the USB Building. The other system, used to provide precision positioning, receives both the L1 and L2 signals via the Rouge antenna located near the 9 meter USB antenna. A new GPS system has been added as part of the USB telemetry upgrade.

F. USB Receiving System: The USB was previously used to detect extra-galactic signals in the 2200-2400 (S-band) and 8200-9000 (X-band) MHz band using a 9 meter parabolic dish. However, the system has been modified to participate as a S-band telemetry receiver in the upcoming U. S. Navy's (USN's) Theater Ballistic Missile Defense (TBMD) exercises. The USB also has the capability to serve as an extra-galactic receiver for S-Band signals in the 2200 to 2400 MHz band. Unlike the VLBI system, a Microwave Component and Systems WR-430 bandpass filter now protects a MITEQ AMF-4F-022024-05-10P-N low noise amplifier (LNA). The LNA has a 55 dB gain, 30° Kelvin (K) noise temperature, and a +1 dB output gain compression point of +10 dBm. The received S-Band signals are down converted to intermediate frequency (IF) signals at the antenna. The IF signals are routed back to the USB Building for detection and processing. The minimum look angle is +5 degrees and the -3 dB beamwidth is 1.0° for S-band reception.

G. VLBI Receiving System: The VLBI system used jointly by NASA and the USNO employs a 20 meter parabolic dish to detect signals from extra-galactic sources in the 2185-2415 and 8143-9000 MHz range. Fourteen frequencies, six in the S-band and eight in the X-band, are monitored using detection bandwidths of 2 MHz. The VLBI also employs a LNA and down conversion process to amplify and route captured RF signals from the antenna back to the USB Building. The maximum system noise temperature for both bands are 32° K. The VLBI antenna requires a 360° azimuth and +5° to 90° elevation obstruction free look angle. The 20 meter VLBI antenna -3 dB beamwidths are 0.56° and 0.14° for the S- and X-band, respectively.

1. In the S-band, the VLBI system noise level is -120.8 dBm for a 2 MHz bandwidth. During VLBI operations, a calibration signal 20 dB above the threshold level (-100.8 dBm) is injected at the input to the LNA at every 1 MHz interval in the operating frequency range.
2. Typical sets of S- and X-Band frequencies used are:
 - a. National Earth Orientation Service (NEOS)-WB: 2.212, 2.222, 2.257, 2.297, 2.317, 2.322 GHz (S-band) and 8.182, 8.222, 8.422, 8.562, 8.682, 8.782, 8.842, 8.862 GHz (X-band).
 - b. Crustal Dynamics Project (CDP): 2.217, 2.222, 2.237, 2.267, 2.292, 2.302 GHz (S-band) and 8.210, 8.222, 8.250, 8.310, 8.420, 8.500, 8.550, 8.570 GHz (X-band).
3. The VLBI program has a reoccurring experiment every Tuesday from 1800 Universal Time (UT) that runs for 24 hours. This experiment is always conducted. Added in during the week are other experiments.

APPENDIX B

FREE SPACE PROPAGATION FORMULAS

1. Free space propagation formulas were used to calculate the electromagnetic radiation (EMR) level at a given distance from a radiating antenna. The calculations are valid only for far field distances from the transmit antenna.
2. Free space propagated minimum safe separation distances were calculated using the following:

$$D_s = \text{SQRT} (30*P*(10\exp(G/10)))/H \quad \text{Equation 1}$$

where: D_s = minimum safe separation distance (meter)
 P = transmitted power (watts)
 G = antenna gain (dB)
 H = hazard level (volts/meter)

3. The near field/far field transition distance is dependent upon the antenna used and the frequency transmitted. The following were used to determine the near field/far field transition distance:

for r less than $\lambda/2$: $F_d = \lambda/2\pi$

for r greater than $\lambda/2$: $F_d = 2*r^2/\lambda$

where: F_d = near field/far field transition distance (meters)
 r = maximum antenna dimension (meters)
 λ = wavelength of transmitted frequency (meters)
 $\pi = 3.1416$

4. The calculated EMR level within the near field/far field transition distance will typically be higher than the actual EMR level. Therefore, the calculated separation distance will be greater than required; i.e., the worst case separation distance.

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